SEXTANT

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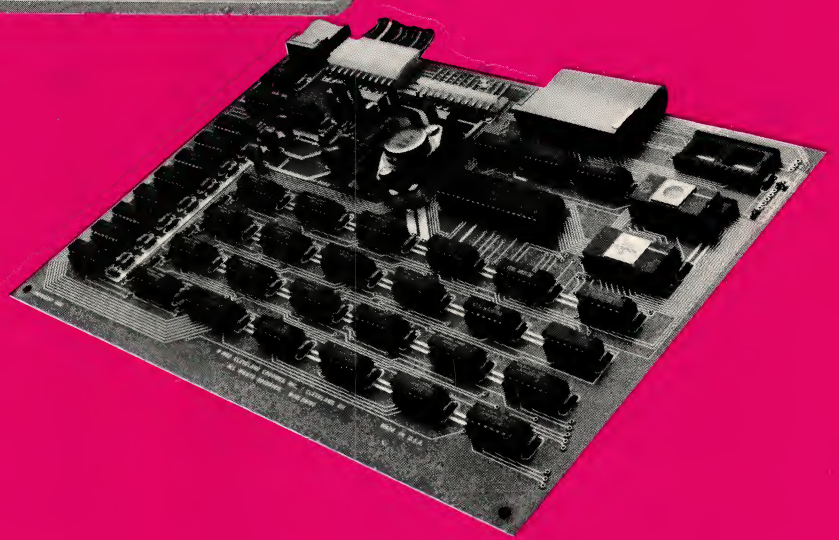
May-June 1985
Issue No. 16

The Independent Magazine for Users of Heath/Zenith Microcomputers

Great Graphics on the '19 and '89



C.D.R. Speeds Up the '100

CP/M Plus for the '89 or '100

Date Your HDOS Printouts Automatically

A Critical Look at Heath/Zenith CPUs

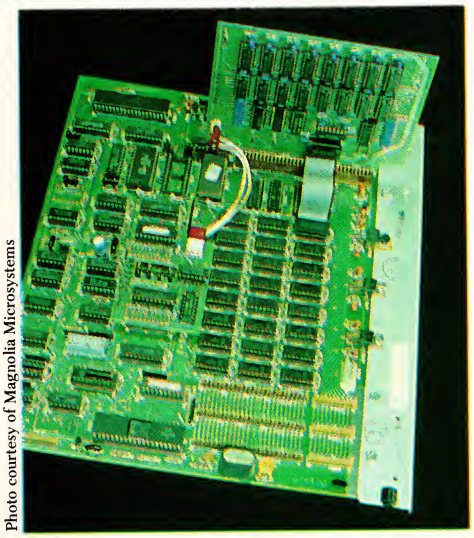


Photo courtesy of Magnolia Microsystems

9

Digital Research's CP/M Plus gives the 8-bit computer user access to more than the usual 64K limit on memory. Not coincidentally, Magnolia Microsystems sells a 128K memory board with CP/M Plus for the H/Z89. So you can add more memory to your '89—and make better use of it.

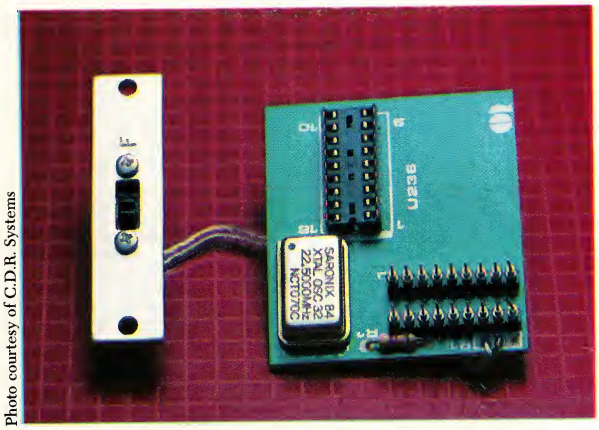


Photo courtesy of C.D.R. Systems

15

There have generally been two obstacles to speeding up the Z100 from its 5-megahertz speed to 8 MHz. Some *parts* won't work at 8 MHz, and some *programs* won't run correctly at the higher speed. The ZS100 from C.D.R. Systems will take your '100 up to 7.5 MHz, which is slow enough for most parts but fast enough for most people. And they provide an external switch for the module, so if you have problems with the higher speed, you can switch it back.

SEXTANT

Features

CP/M Plus Exploits More Memory
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Speed Up Your '100 50%
Wayne Rash, Jr. 15

CHUGCON 84—Back for More
Mark Goodkin 19
Following a tradition of successful conferences, the Heath community's largest local club put on a bigger and better show in 1984. Users came from up and down the East Coast, and vendors came from around the country.

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Charles Corbin 31
When you think of things you could use a data base program for at home, it probably doesn't send you rushing out to spend hundreds of dollars on a program with bells and whistles and its own programming language built in. But it would be nice to have a simple program to keep track of your bowling club, local HUG, or your record collection. And it would be nice if it cost less than $100. It does.

HUGCON West Takes Off
Mark Goodkin 37
Now the West Coast has its own local HUG conference. Coordinated by several Southern California Heath Users' Groups, the first Western Regional HUG Conference took place at the Disneyland Hotel. Although Mickey Mouse may seem like tough competition, the scheduled talks and panel discussions and the vendor exhibits drew crowds.

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Add an Automatic Brightness Control to Your '89 45
Ray Albrektson
Have you noticed how your '89's screen seems to get dimmer when the sun shines on it? Or how awfully bright it seems when the room is dark? If you're lucky, there's a knob on the back to adjust the brightness of the screen. The easiest solution, of course, wouldn't require you to do a thing when the light changes—the screen would adjust itself. Well, it turns out it *is* an easy solution. For under $2, you can build it yourself.

SYMON Says: Challenge Your Memory 51
Edward A. Byrnes
This version of "Simon Says" is more of a memory game than the original. And both of them may be more suitable for someone younger than yourself. But this one comes in *three* kinds of BASIC.

Date Your HDOS Printouts Automatically 69
Jonathan Booth
An easy way to include the date on printouts takes advantage of features of HDOS and your word processor. This one is based on The Software Toolworks' TEXT. It will take the date from the operating system and put it anywhere you specify in a file.

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Cover photos courtesy of Cleveland Codonics

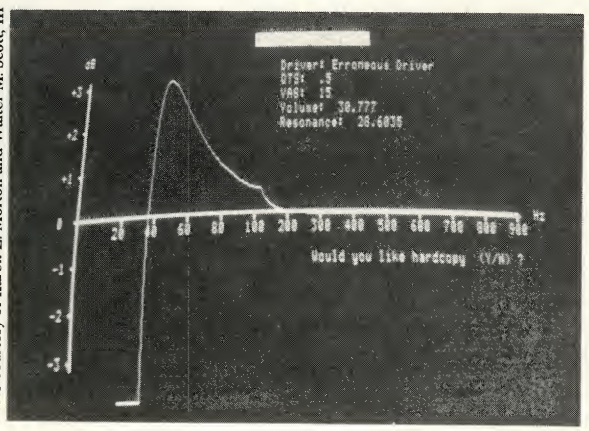
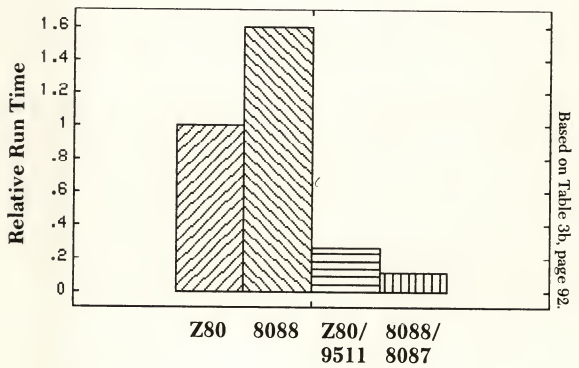


Photo courtesy of Karen L. Morton and Walter M. Scott, III

25 If it's graphics resolution you want, you might think twice about trading in your H8 or H/Z89. Cleveland Codonics' Imaginator board gives you six times as many dots as you get with the '89's block graphics. It may be a challenge to program, though. WIzard Software House's Illustrator makes that a lot easier.



75 The 8088—the central processor of the Z100, the Z150, and the IBM Personal Computer—why did Intel design it? Why did Zenith and IBM choose it? How does it stack up against the other CPUs on the market? Not too well, on its own. But with a math chip, it—and the H8's Z80 CPU—improves dramatically.

The Editorial Eye

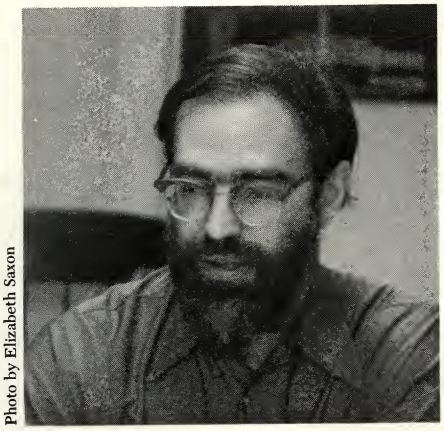


Photo by Elizabeth Saxon

Who says the adventure is gone from personal computing? I recently had some interesting experiences involving a Texas Instruments Model 865 printer, a Z150, and a Z110. The 865 is a dot-matrix printer rated at 150 characters per second in "draft print" mode and 35 c.p.s. in "quality print" mode. The latter uses about seven times as many dots to form each character, and produces output comparable to that of a daisywheel printer. Another factor in the 865's versatility is its ability to communicate with a computer through either a serial or a parallel interface. We expect the 865 to spend most of its time linked to the parallel port of our Z150. But it's nice to have a back-up for the printers hooked to the serial ports of our other computers. (I may even use the 865 to print the address labels for this issue of *Sextant*.)

For about a year, we'd tried to get by using one or another of our serial printers with the Z150. Sometimes they even worked together. But not consistently. I thought our problems would be over once we bought a parallel printer.

The first surprise came when I discovered Texas Instruments doesn't pack a printer cable with the 865. It shouldn't have been a surprise, because TI makes three different cables for this printer. And most printer manufacturers don't include a cable. But I did get one with the H25 kit, and our NEC Spinwriter 7715 has the cable permanently attached.

So I had Advertising Sales Assistant Bryan M. Rutberg buy a printer cable during his next trip downtown. Meanwhile, I satisfied myself with using the test mode of the 865 to get samples of its printout at different settings. I was very happy with the results.

Unfortunately, once the 865 was hooked to the Z150, it wouldn't do a thing. Even the keypad controls for character and line spacing seemed to be frozen. So I hooked the new printer to the parallel port of our Z110. It worked just fine. Could the parallel interface board of our Z150 have a problem?

I hoped not, so I borrowed a printer cable that I knew was good, but the results were the same. And a close examination of the interface board didn't reveal any obvious problems. Nor were the symptoms any different after the board was reinstalled. So the moment of desperation had arrived. I decided to read the documentation a little more thoroughly. The clue to getting the parallel interface to work was in the section of the MS-DOS manual dealing with hooking up a *serial* printer.

So I ran CONFIGUR. From the first menu I chose: "A. Configure LPT device." The trick was in the LPT menu that showed up next. I picked: "A. Map parallel output to serial output." That brought up a menu that allowed me to indicate I wanted to map LPT1. Finally I got to the command: "Use one of the following to select a mapping for LPT1." Page 11.89 of the manual explains: "Option A (No Mapping) is used to undo a previous remapping or *unmap*. This returns the system to the default values."

So I never would have had all this fun if I hadn't tried to use the Z150 with one of our serial printers before deciding to buy a parallel printer for it.

Charles Floto

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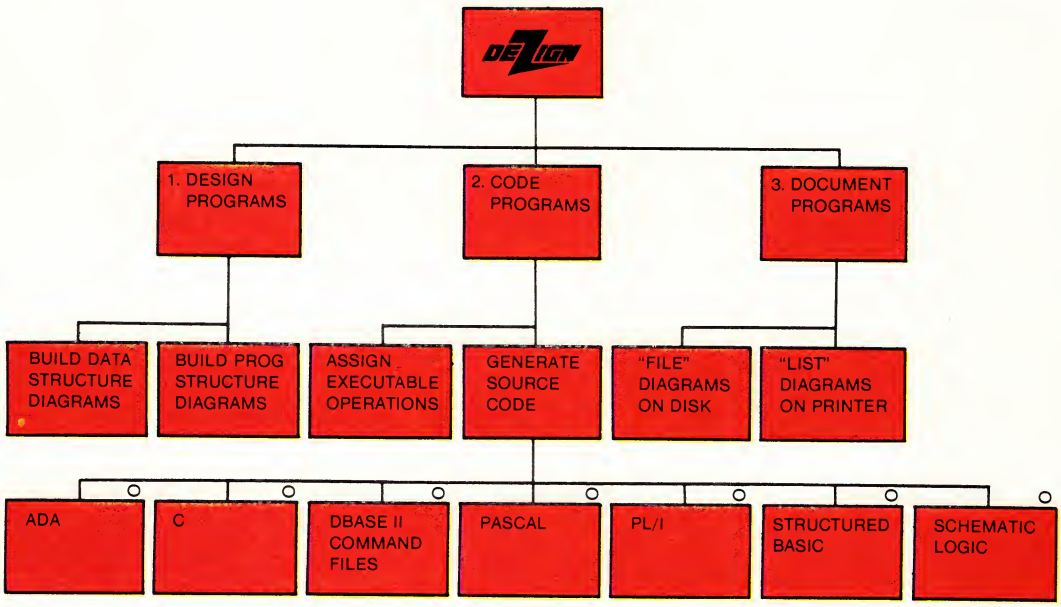

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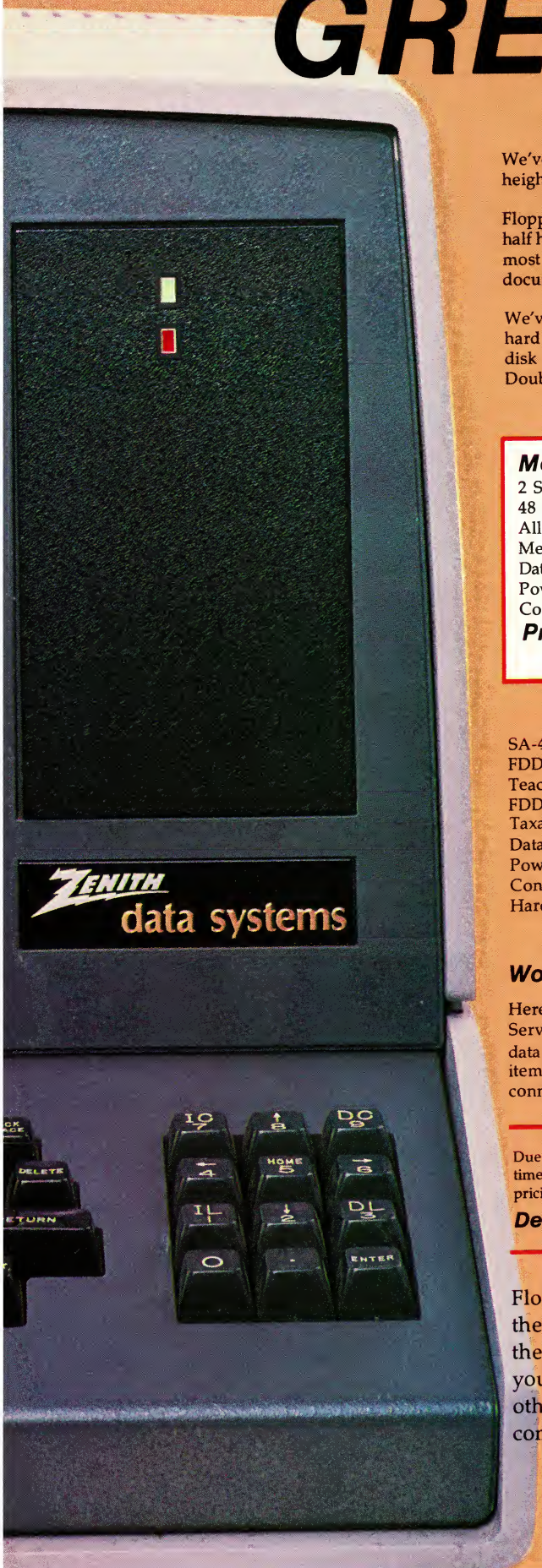

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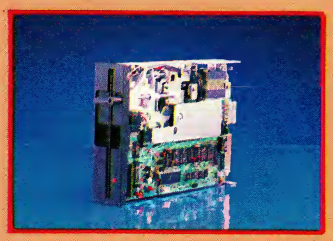

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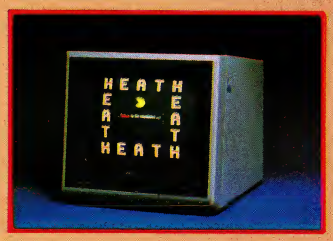

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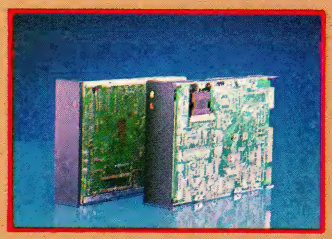

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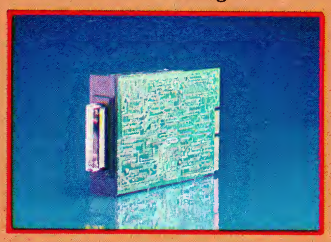

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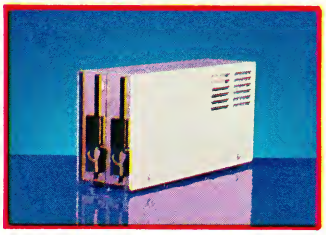

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Letters

Two Years Late

Mr. Rash's article on the TMSI H-1000 board in your January-February issue has essentially all of the information we Heath H89ers need to make an intelligent decision on whether to upgrade or purchase an H100.

Unfortunately, this article is about two years late! It also doesn't discuss some of the questionable ads placed to generate orders during periods when TMSI couldn't deliver their boards in a reasonable time or answer questions as to shipping delays on other related products such as operating software.

I purchased an H-1000 board over two years ago and have yet to operate it in the 16-bit mode. I originally ordered it without the operating system, erroneously assuming from the ad all Heath software (including the operating system) would run. It wouldn't run Heath CP/M-86. I experienced that disappointment nearly a year later after many expensive long-distance calls to check delivery dates they never met.

Incidentally, the board didn't work in 8-bit at first and was returned.

Rather than argue over the situation and suffer any more humiliation from my friends who have IBMs or Apples that work beautifully, I purchased TMSI's PC-DOS software to get started, since after a year I had cause to choose it over CP/M. That was over three months ago and I haven't even received a notice of why my shipment is delayed. Two expensive long-distance calls have netted me nothing except promises.

I wonder what other Heath H-1000 users report? Can you present a summary? What is Wayne Rash's view on the H-1000 (personally)? Does he use one or did he just report on it for purposes of writing this article?

I would like to see a clearinghouse for H-1000 equipment problems initiated by someone with expertise in using the board.

B. W. Johnson
Oakland, CA

Although there was an initial period when TMSI was not delivering boards in a timely fashion, we have not heard of this problem for some time. Since the purpose of the review was to inform potential customers, we did not cover these startup problems.

Regarding the operating-system software, since the operating system acts as a bridge between a specific computer and other software, it's usually necessary to buy the operating system for your particular machine. It would be nice, though, if customers were reminded of this necessity.

TMSI loaned Mr. Rash an H-1000 board to review; he did not purchase it afterwards.

Please Desert '150 Owners

I must disagree with Mr. Flynn, of Hopkins, MN ("Letters," January-February *Sextant*). Please *do* "desert" the H/Z150 owners. The article on Microsoft Word and Mouse, for example, was of no use to anyone but an IBM PC or PC clone owner; it contained nothing a '150 owner couldn't read in *PC World* or *BYTE*. Those of us with real Heath machines have only you (*REMark* being far from independent), while the PC-clone crowd has virtually every non-Apple magazine for their needs. Those 3¾ pages could have been better used, and I was a bit disappointed.

Rick Downer
Seattle, WA

At the time we published the review of Microsoft Word, a version for the '100 was about to be released; we referred to it in the table of contents. The part number for the Z100 version is MS-463-9.

Proportional Printing With PeachText

I'm currently developing a tutorial on PeachText for Air Force personnel and was interested in Alison Phillips' comments on PeachText in the March-April issue ("Z100 Notebook"). I hope the following remarks on proportional printing with PeachText and the Diablo 630 are useful.

Diablo sells a proportional printwheel that prints all 96 ASCII characters exactly as displayed on Zenith terminals [with unslashed zero]. The Diablo part number is 311901-01 and the type is called "Cubic PS-96". The correct printwheel select switch setting is 4 (96D Metal). The 9R80303 Bold PS printwheel that Mr. Phillips mentions is a 98-character printwheel designed for the Diablo 620. It is incompatible with the 630.

PeachText maintains two tables for proportional printing. The first table (located at 4DD3H in PRINT.PGM) is a lookup table that maps ASCII codes to spoke positions. This table requires no modification for use with the Cubic PS printwheel. The second table (located at 4D53H in PRINT.PGM) is a spacing table that contains the spacing for each of the 96 ASCII characters. The configuration program does not allow you to specify which particular proportional printwheel you are using with the Diablo 630 as it does with NEC and Qume printers. The spacing table requires only one modification for use with the Cubic PS printwheel. The space allocated for the letter "m" needs to be increased from 0EH to 10H (use DEBUG, location 4DA0H).

Setting the Diablo pitch-select switch to 12 characters per inch is not critical. PeachText constantly changes the Horizontal Motion Index while printing proportionally. What is critical is that the Diablo 630 pitch select switch *not* be set to PS; in that case, the contention that Mr. Phillips mentions ("PeachText and the Diablo shouldn't both try to run the show") occurs (assuming the Diablo supports proportional printing in firmware—which is optional).

One final note. When using justification in conjunction with proportional printing, be sure to use the JUST command instead of the JUSTC command. The results are much more attractive.

Charles E. Morgan
Maxwell AFB, AL

XYZZY ON

This letter is in regard to [Alison Phillips'] questions concerning the use of the "XYZZY" command in MS-DOS. You have apparently discovered an undocumented feature. As you may be aware, whenever any program returns to the operating system, it may return a value indicating the success or failure of the program. (Indeed, the value returned may have any meaning the programmer desires.) For a more formal discussion of exit codes, refer to the section of the MS-DOS manual discussing .BAT files and the IF ERROR LEVEL batch command (see page 11.222). This batch command is used to test the exit code value in a batch file.

As is fairly obvious at this point, the "XYZZY ON" command simply displays the exit code upon the operating system being re-entered after a transient program has been executed.

Somewhat more interesting is the source of the rather unusual spelling of the command. For those who don't recognize it, XYZZY is a "magic word" used in the original Adventure game! I wonder if there are any other undocumented commands, such as PHUGGG or PLOVER? Has anyone tried "WAVE ROD"?

Steven J. Finnegan
Poway, CA

Another HUG SUBMIT Program

I am a longtime fan of *Sextant* and have always enjoyed reading your informative and accurate articles. However, I was surprised and puzzled while reading the article "Put HDOS Commands on Disk" by Roy Coleman in your January-February '85 issue. Mr. Coleman claims that there is no widely available com-

mand processor for the HDOS operating system. On the contrary, HUG offers an extremely powerful command file processor called "HDOS SUBMIT," PN 886–8006. This utility should not be confused with the simple SUBMIT program that is supplied with the Disk VII Utilities Package.

The 'problem' here is that HUG offers *two* programs entitled SUBMIT. The original program that comes on disk VII is as Mr. Colemn describes it—a very restrictive command processor. The second utility (#886–8006), on the other hand, is a *very* complete command file interpreter providing: command files up to 256 lines in length; up to 10 command file parameters; message display; interactive user query; command file debugging; conditional and unconditional branching; conditional execution of HDOS commands via parameter value tests and file existence tests; special command file variables providing a command line argument count, the HDOS system date, and the name of the command file that is currently being executed. I think you'll agree that some of the above features are only found on some of the 'newer' microcomputer 'batch file' command processors.

This utility was announced and described in *REMark* Issue 31, August 1982! So, it is not a new product. It was written in 8080 assembly language and uses techniques that are quite similar to those described by Mr. Coleman in that it utilizes the HDOS type-ahead buffer extensively. Other than that, it offers significantly more capabilities.

I must admit that I am partial to HUG's second version of SUBMIT since I am its author and have been using it daily for the last three years. But I have received letters from other users of the #886–8006 version of SUBMIT who are equally satisfied with its capabilities.

You might want to check out the program yourself and see if you don't agree with me.

Keep up the good work.

Brian W. Downs
San Francisco, CA

Apologies

In reference to Tom Campbell's letter in the March-April *Sextant*, I wish to apologize to HUG-GA for stating that the Atlanta HUG is run by the local HEC manager and staff.

On a more pleasant note, I recently constructed the Heathkit ID-4803 EPROM Eraser and would like to recommend it to your readers.

John W. Spalding
Atlanta, GA

Getting the Most Out of Non-Standard Paper

I read the article by Mr. M. H. Endres, "Getting the Most Out of an Okidata Printer under Z-DOS" (January-February 1985) with much interest, as my company sells a product which we think gets the most out of Okidatas.

I was frankly puzzled at Mr. Endres' comment that "the tractor feed cannot be moved far enough to the left to avoid printing over the perforations when one wishes to use inexpensive 8½"-wide green-bar paper . . ." because that just didn't square with my experience. I would hate to see readers shunning this printer because they believe it to be badly designed, when the opposite is actually true.

It appears that Mr. Endres' troubles are a result of his use of non-standard paper. The Okidata 92 comes with both pin-feed and friction-feed built in. The pin-feed pins, however, are spaced to accept 9½"-wide paper (which tears down to 8½" without perforations). His paper isn't wide enough to ride on both sets of pins, so he has had to use the optional tractor-feed. Rather than start the paper so that the left perforations catch on both the pins and the tractor, he has chosen instead to *center* the paper so that it bypasses both sets of pins.

Having done that, the pin-feed pins serve to limit the movement of the paper from side to side, and it is then *the paper* that keeps the tractors from moving all the way to the left. The solution is to move the tractors into position first, load the paper so that the left-hand perforations catch on the pin-feed pins, and then feed the paper into the tractors.

It is a lot more complicated to describe than to do, and I am surprised that Mr. Endres didn't do it that way. This is not to belittle the contribution of the configuration program, however. Although it addressed a non-problem in this instance, there are plenty of other situations where Mr. Endres' program would be useful. One of my first projects following the delivery of my Okidata was to develop a similar program, although I chose to write it in assembly language so that I wouldn't have to mess with the BASIC interpreter for each printer setting.

John D. Toppins
Wheatstone Systems
227 Wisconsin
Lawrence, KS 66044

Z100 Notebook

I would like to express my delight over the new column "Z100 Notebook." It's great! And the multi-subject Jerry Pournelle-style format is perfect. I'll be surprised if your H89 users don't clamor for the same thing.

Rick G. Martin
Englewood, CO

Corrections

Two lines were omitted from Listing 1 in "Another Approach to Command Processing Under HDOS," in *Sextant* #15, March-April 1985. In section 14, after the line

```
JZ      ECNEM   yes, error: not enough
                memory
```

the following lines should be added:

```
XCHG            put pointer to process
                buffer in DE
LXI     H,FBUF  point to start of shell file
```

The price given for ROOTS II in "ROOTS Gets the Family Into Your Computer" (*Sextant* #15) was an introductory price. The current price is $195.

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CP/M Plus Exploits More Memory

Magnolia Microsystems sells CP/M Plus with a 128K RAM board for the Z89. You'll thank them for the memory.

Jack L. Goertz

'89 owners—take heart! It is not necessary to dump your 64K machine and spend $3,000 or more for an H/Z100 or H/Z150. Rather, spend $495 (suggested list) for Magnolia Microsystems' 128K memory card and CP/M Plus.

What is CP/M Plus? CP/M Plus, also known as CP/M 3, is Digital Research's latest 8-bit operating system. It allows the use of banked memory—memory in excess of the normal 64K address range of the Z80 central-processor unit. This gives the user a larger Transient Program Area (TPA), which in turn allows the user to run larger programs than can be run under CP/M 2.2.

CP/M Plus has been out for a while now. And in fact, you may have heard that Digital Research is no longer selling it. That's only partly true. Digital Research has stopped selling CP/M Plus directly to users. But they are still licensing developers like Magnolia to sell it along with hardware. Those developers, though, can *only* sell CP/M Plus to run on *their* hardware. You'll have to buy Magnolia's 128K board to get CP/M Plus from them.

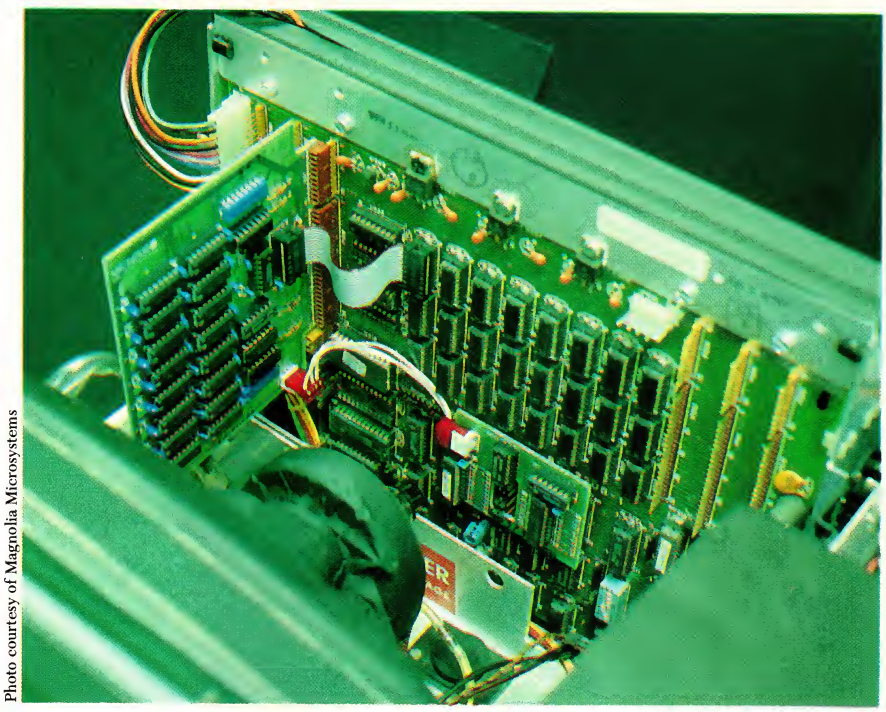


Photo courtesy of Magnolia Microsystems

But if you are interested in CP/M Plus, you will almost certainly *want* to buy a random-access memory (RAM) board to boost your H/Z89's memory over its current maximum of 64 kilobytes. For most of us, the whole point of CP/M Plus is that it will let our Z80-based computers handle the larger memory and provide the increased TPA. Magnolia's board replaces the 16K board on the '89's left side with 128K of RAM. With the motherboard's 48K, that gives you a total of 176K.

Magnolia's implementation of CP/M Plus, with their 128K card, gives Heath/Zenith users a TPA of 57K. In terms of program size, this will allow a user to load and work with a Multiplan file of 24K-28K, or roughly twice as large as can be used with an H/Z89 running CP/M 2.2 with 64K.

CP/M Plus adds more than just a larger TPA, although for me, that feature alone was why I purchased it. The extra memory now available is also used to increase speed and peformance.

For instance, CP/M doesn't have to go back to the disk to read the directory every time a file is accessed. The directory is kept in memory. So file access is as quick for a file at the end of the directory as for one at the beginning. (And CP/M Plus doesn't need to get a CTRL-C every time you switch disks. The housekeeping is done automatically.)

And say you've accessed the disk and now want to look at something nearby the disk sectors you've just read. Under CP/M Plus, there's no need to wait for the system to go back to the disk the second time. When data is read, CP/M Plus puts adjacent data above and below it into memory. It's already waiting for you.

Digital Research has also added other features to CP/M that make this operating system a quantum leap ahead of other 8-bit operating systems I am familiar with. In my opinion, it is even better than the most popular implementation of the Microsoft Disk Operating System (MS-DOS), PC-DOS 1.0/2.0 running on the IBM Personal Computer.

Date and time

There is now a date/time feature which programs can use. The system uses it to date-stamp every file after an update, and either upon file creation or after file access. (You have your choice; you can set any two of the date/time stamps, except that CREATE DATE and ACCESS DATE are mutually exclusive.) The directory has been expanded to accommodate the date/time feature. After you tell the system which two date/time stamps are to be recorded, all files will be so marked. (Be careful in choosing which two stamps go in the directory, though. Many programs will actually create a new file when you think you're just modifying an existing file!)

Calling up a full directory, using the DIR [FULL] option, will display the two date/time stamps you chose for your files. This is a very useful feature to help you determine the last time you updated a file.

However, if you do not have a built-in clock, you must provide the date and time every time you boot the system. (Otherwise, the date will always be the creation date of your CP/M Plus system.)

Setting the date/time is not too much of a hassle, though. You can create a SUBMIT file and call it PROFILE.SUB; CP/M Plus will call this up automatically upon booting. (PROFILE.SUB works almost exactly like AUTOEXEC.BAT under MS-DOS.)

I use PROFILE.SUB mainly to set my drive chain. (The drive chain is the order in which the operating system searches disk drives to locate a .COM or .SUB file when you call for it on the command line.) My PROFILE.SUB file also invokes the DATE SET command, just as a friendly reminder for me to fill in the date and time.

Of course, I could just hit <RETURN> to bypass the DATE feature. But then all my files would be dated the same.

Better directories

One of CP/M 2.2's major shortcomings has been that when you are logged into a given USER area, you can't access a program or program overlays found elsewhere. Under CP/M Plus, any file can be designated as a SYSTEM file. A system file can be stored under USER 0 and accessed from any other USER area. This feature eliminates the need to keep a copy of each program in each USER area.

Another feature I have found useful is the ARCHIVE flag. This is automatically set to "FALSE" when a file is created or modified. You can then use the PIP utility with its [A]rchive option set to copy only those files which have not yet been archived. (And then PIP [A] will set the ARCHIVE flags to "TRUE".)

A good way to use the ARCHIVE feature is to create a SUBMIT file named BACKUP.SUB; this would have the commands in it to find files which haven't been backed up yet. It would then PIP them from the source disk to a back-up disk in another drive.

Files, as well as disks, may be password-protected. Use this feature with care, though, since a file password is encrypted when it appears in the directory label. You cannot decipher the password with any of the file editors such as DDT or SID. Or at least I can't.

This means that you can't copy, erase, or read any file for which you have forgotten the password. There is only one way I know to erase the file and free the space: copy the other files to another disk and reformat the disk. Drastic!

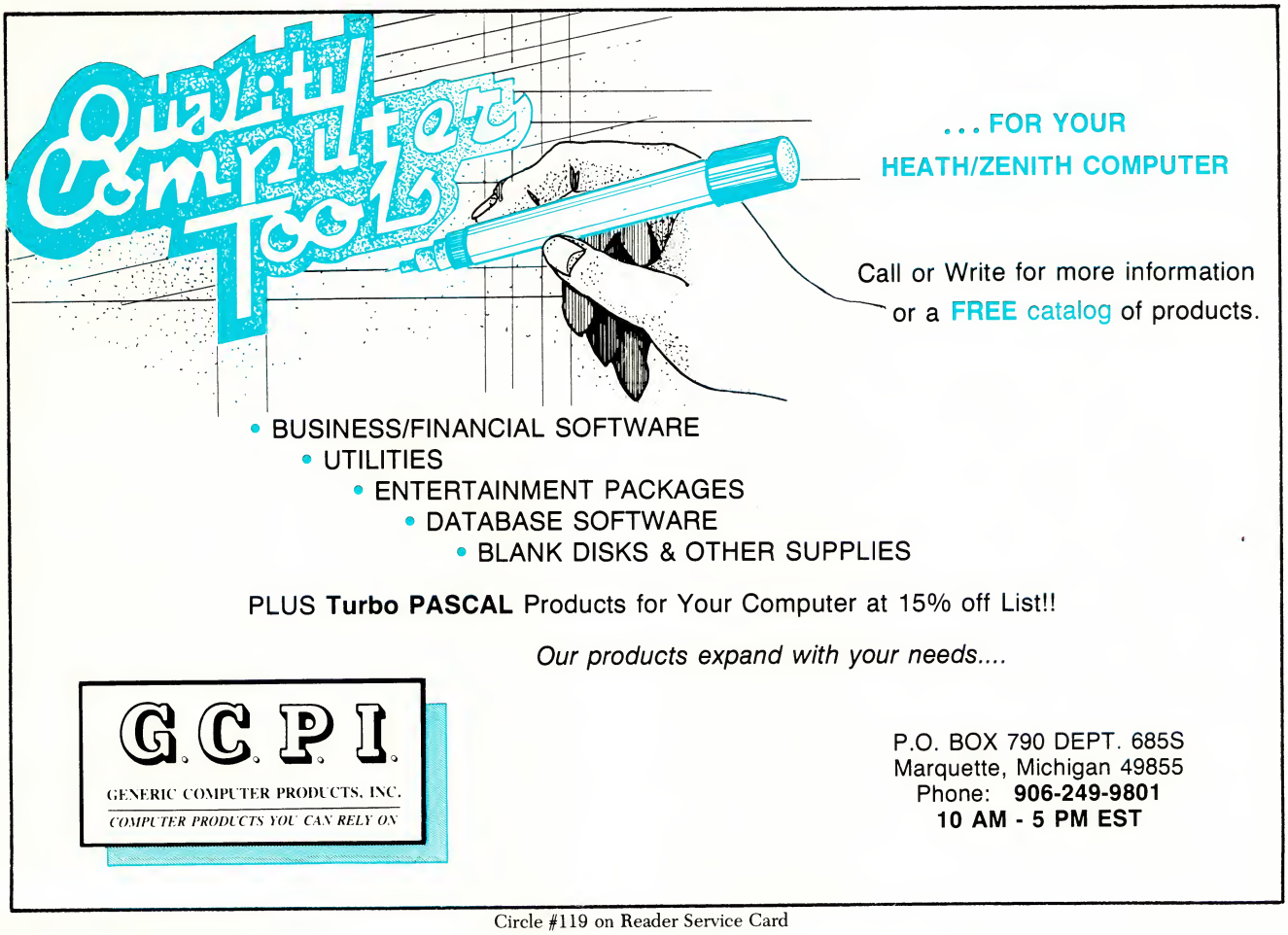
GET and PUT

Two of the new commands available for the first time under CP/M Plus are GET and PUT. GET allows you to provide input to a program from a file, rather than from the console. (The file can be either data or commands for the program.) One option will allow you to ECHO or NO ECHO the input to the console. And with the SYSTEM option set, *all* input must come from the disk file. Console input is ignored until the disk file is exhausted or returns control to the console.

PUT is similar, although it is slightly more flexible. Program output bound for your printer can be intercepted and PUT to a file. You can also PUT it to the console; or you can intercept program output bound for your console and PUT it to the printer or to a file. Of course you can ECHO it to the console at the same time.

One option I have found useful with the PUT command is the FILTER or NO FILTER option. With FILTER, control characters (printer-control commands, for instance) can be stripped to provide a plain ASCII file. When I use the NO FILTER option, however, I can intercept my word processor's output to the printer and PUT it to a file with all the printer-control commands still embedded.

If I then transfer this file to someone else's computer, they can print it out without using any program (TYPE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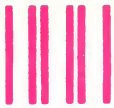

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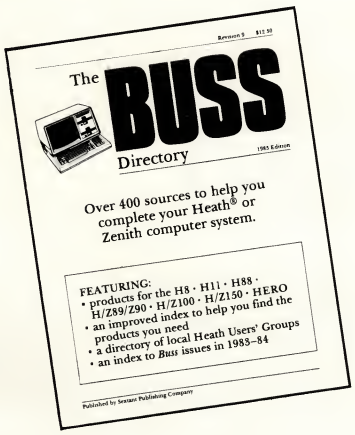
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FNAME.TYP ^P<CR>). Or I can print it out later myself, without loading my editor.

Since writing to a file is much faster than writing to the printer, you can redirect all your printer output to files, then print them all at once using the TYPE command with a CTRL-P, or LIST with wildcards.

The HELP command

Forget a CP/M Plus command? Don't want to look it up in one of the manuals? (By the way, the documentation is now excellent!)

Use the HELP command. This utility allows a user to request information on any of the CP/M Plus commands listed in the manual. Detail is provided to a depth great enough to explain the topic to most people's satisfaction.

If the detail is not sufficient, you can expand the HELP data file and add the topics you want. You use the HELP [CREATE] command to set up the HELP data file in a form in which your word processor can edit it. Then the HELP [EXTRACT] puts it back into the form that HELP.COM needs to see.

Even the documentation is helpful

Now that you have some idea of what CP/M Plus offers, you should be asking what it is like to use. After six months of CP/M Plus usage, I am thoroughly hooked!

The documentation is excellent. If the documentation from Digital Research for CP/M 2.2 rated a–1 on a scale of 1 to 10, then the Heath/Zenith-supplied documentation rated about a 3. On that scale, Digital Research's CP/M Plus documentation rates at least a 7. Sometimes I think it may be even higher.

It is well organized into two volumes: one for use as a general reference manual; and one for aiding advanced users with the utilities Digital Research has included with CP/M Plus. And Magnolia includes documentation on the utilities unique to their implementation.

I often use the reference manual to answer even small questions. I can really find the answer, and understand it, too. This last was a rare occasion under CP/M 2.2!

And it's compatible

CP/M Plus lives up to all my expectations. It doubled my TPA; it operates with most of the same commands that I was familiar with under 2.2; it works with my extensive software library of 2.2 applications from FORTRAN 80 to BASCOM to Multiplan to WordStar to SuperCalc. (SuperCalc runs under CP/M Plus, but does not recognize the expanded TPA.)

Most public domain packages also work, with a few exceptions. Any programs which directly modify or access the directory probably will not work. This includes the latest versions of SuperDirectory (Bruce Ratoff's implementation) and, unfortunately, UNERASE.

CP/M Plus will read 2.2-formatted diskettes without modification; although the date/time stamps will not be activated, of course. With the INITDIR command, though, the date/time stamps can be used.

INITDIR initializes a 2.2 directory to allow date and time stamping of files on that disk. Or it can do the opposite—that is, convert 3.0 disks to run under 2.2 by removing the date and time stamping.

(*Warning:* do *not* write to a disk which has been SYSGENed with Magnolia's implementation of CP/M 2.2. You'll overwrite USER AREA 31—which will render the disk unbootable. Magnolia provides a patch for 2.2 which will allow you to boot with these disks.)

Creating a CP/M Plus system disk for your system should be fairly simple, following Magnolia's instructions. Magnolia assumes you have two identical high-capacity disk drives, either 5¼" H/Z37s or 8" drives such as H/Z47s or equivalents.

I wanted to make my single 8" double-sided/double-density Tandon my boot drive. To accomplish this, I had to create a boot-loader routine for an 8" drive from the modules supplied by Magnolia. Then I copied this routine onto the system tracks of the 8" disk using the Magnolia-modified utility COPYSYS. This procedure is not documented in any of the manuals supplied, but it works fine.

Is it worth it?

Is CP/M Plus worth the investment? Yes, if you have "outgrown" your 64K H/Z89 and you have hundreds of CP/M 2.2 software applications you can't afford to replace with 16-bit versions.

CP/M Plus is everything it is advertised to be; and the modified system is still compatible with CP/M 2.2. As an added bonus, too, with the proper software CP/M 2.2 can use the Magnolia memory above 64K as a RAM disk.

Consider CP/M Plus and the Magnolia 128K card before you scrap your '89. You may find it to be the right choice for you, too!

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CP/M Plus for the Z100

An implementation of CP/M Plus for the Z100 has been developed by Barry Watzman. His CP/M Plus has all the features of the standard Digital Research product, plus several extras.

One added feature is the print buffer. Up to 64K of memory not being used by the operating system can be used as a print buffer. This lets you use the computer while you're printing from a disk. It also buffers output generated by a program while the program is still running.

Another feature unique to Watzman's implementation is a memory disk—RAM that acts like a super-fast disk. The memory disk can use the memory not being used by CP/M Plus or the print buffer. You can work on your files in the memory disk until you're through with your session. At that time, if you want, you can move the files from the memory disk to a regular disk.

And if you want to beef up 8-bit programs, Watzman's Z100 CP/M Plus is able to execute 16-bit object code contained within 8-bit programs.

Utilities

Watzman has also added several utilities to Digital Research's product. Some of these simply make CP/M Plus more convenient to use on the '100. For example, one utility lets you flush the print buffer.

Other utilities take advantage of some features on the '100 not found on the '89. For instance, FORMAT formats both floppy disks and Winchester partitions up to 16 megabytes. ASSIGN assigns up to four Winchester partitions to logical drives.

And Watzman's CP/M Plus is fast. One user has reported that 8-bit dBASE II on 8-inch floppies under Watzman's CP/M Plus ran faster than 16-bit dBASE II on a Winchester under Z-DOS.

To order

Z100 CP/M Plus sells for $350. Orders must be accompanied by a signed license agreement, which is available from Barry Watzman.

Digital Research is no longer shipping CP/M Plus for Watzman to sell. Beginning in February 1985, he has been selling from inventory, so quantities are limited.

For information on the availability of Z100 CP/M Plus, and for a copy of the license agreement, contact:
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Speed Up Your '100 50%

C.D.R.'s ZS100 lets you switch your speed between 5 and 7.5 megahertz.

Wayne Rash, Jr.

It never seems to fail. You get a computer that would have seemed lightning fast a year or so ago—but now it's never quite fast enough.

A 5-megahertz machine such as the H/Z100 would have been a marvel three or four years ago. Now that it's been out for a while, many users are asking why Heath/Zenith didn't make it an 8-MHz machine. While the factory-standard 8-MHz version of the '100 is probably just around the corner, that does very little for the user who has one of the current, slower machines.

There are ways to speed the machine up, of course. The speed of the central-processing unit (CPU) is controlled by a single crystal oscillator. All you have to do is replace the proper crystal on the motherboard with a faster one, and the machine speeds up.

There are drawbacks to that approach, though—the most significant being that you have to be willing to take a soldering iron to the expensive, multi-layered motherboard. To make matters worse, the speed change might not work. So you'd have to go through it all again and restore the old crystal to its old location.

Things become even more of a problem if you must use an 8087 co-processor board with your '100. The 8087 now available has been around for some time. This is the 8087-3, and it will not run at 8 MHz. So, you either have to stop using this chip, or not run at 8 MHz until the higher-speed 8087-2 is commercially available.

The only way around this is either to run slower or to make the high-speed oscillator so that it can be switched off. In developing their new speed-up module for the '100, Controlled Data Recording Systems (C.D.R.) took both of these approaches. By that I mean that their ZS100 operates at less than 8 MHz, and it can be switched off if needed.

This is a bigger advantage than it seems at first. It turns out, according to the folks at C.D.R., that almost any '100 will run just fine at the 7.5 MHz speed of the ZS100. And that includes many of those with the 8087-3 math co-processor. In case you have one of the early '100s that has problems at the higher speed, C.D.R. provides a switch that fits on to the back of your '100. It will allow you to run at the slower speed until you change those parts that have problems.

Installing the ZS100

The hardest part of owning a ZS100 is that you have to install it. To do this, you have to take your '100 apart, at least until you expose the motherboard. If you built your '100, this will not be a problem.

If you bought an assembled Z100, then you may be getting the first look you have had into the inner workings of this machine. Never fear, this is really not a difficult process. And by the time you have finished, at least you will have opened up the case and moved some of the boards around.

You're not going to believe this, but the hardest part of the whole operation is getting the top off the computer. With either the all-in-one model or the low-profile version, you have to move two metal slides back until two locating pins are released. For some reason, these slides tend to be a little difficult to position properly. Once this is done, the interior of the computer is open to you.

Now it's time to unhook some of those wires that you see running around inside the '100. Four or five cables will have to be disconnected at this point. They are the data and power cables to each of the two disk drives; and in the case of the all-in-one model, the cable that goes to the cathode-ray tube (CRT). Once this is done, you have to remove the five screws that hold on the top of the lower case. Then you remove this part.

Now you're down to the level of the motherboard and the video board. You're almost to where you can install the ZS100. The last thing you have to do, though, is get the video board out of the way. You do this by removing three small screws, and leaning the video board against the S-100 cage. The keyboard has to be moved too, but it's no longer fastened down by the case.

Now comes the part you've been waiting for. Time to plug in the ZS100. You do this by plugging the module into the space vacated by the integrated circuit (IC) chip at location U236.

At this point, I should mention that you are the one that gets to vacate location U236. You pull the chip that fills this socket using an IC puller (if you have one). Or you do as I did and use your good ol' trusty Swiss Army Knife. Just make sure you're careful. If you slip and poke yourself, you'll bleed all over your motherboard. This may void the warranty.

Once you have removed the IC at U236, you place it into the vacant socket on the ZS100 board. Now you plug the board into the vacant U236 socket, making sure that the pins on the board go into the holes in the socket.

The switch I mentioned earlier is attached to the ZS100 by a twisted pair of wires about 10 inches long. You mount the switch into one of the DB25 positions on the rear of the computer, using the two screws and nuts provided by C.D.R. After you do this, make sure that the wires are routed where they will not be damaged when you put the computer back together. You assemble your '100 in reverse order of the way you took it apart.

Trying it out

OK, you got it all back together. Now comes the time to see if your new ZS100 works. The manual says to try out the module at the slow speed first; make sure that the board itself is operational before trying out the high speed.

Set the speed switch in the position opposite the "F" on the mounting plate, and turn on your computer. Most likely, it'll beep twice and all will work as it should. If not, check your installation; make sure it's done properly.

Now comes the fun part. Turn off the computer and move the switch over to the "F" position. Turn the computer back on. If it beeps twice again, and seems to run properly, you're OK. Do a directory listing. It's a *lot* faster. Run WordStar. Run some benchmarks. No matter what you do, everything done on the 16-bit side of the computer will run about half again as fast, unless it's slowed down by floppy disk accesses. Even the 8-bit side of the '100 will run a little faster, since the 16-bit side manages the memory and display, and is still running faster.

The most notable changes will be in programs that run primarily in memory. Lotus 1-2-3 and other spreadsheets show a significant increase in speed, for example. While the overall increase in speed is not overwhelming, it is noticeable. WordStar moves the text files around much faster, making it a delight

to use. For once, there s an advantage to using the 16-bit stuff.

The benchmarks

I performed two benchmark tests of the ZS100 to determine the speed increase produced by the ZS100. These were a global reformatting of a 39,552-byte file done by WordStar, and a Sieve of Erastothenes program running under Z-BASIC. Both were performed using the Microsoft Disk Operating System (MS-DOS) version 2.13 on a Z100, a ZFG-121-32.

The times are noted in Table 1. As you can see, the operations are completed much faster. The times for the WordStar file reformat included a few disk accesses. The sieve program was loaded from disk into memory before it was run.

	Sieve	Reformat
5 MHz	280	374
7.5 MHz	181	257

Table 1. Run-time results (in seconds) for two benchmarks on a Z121 with the ZS100 at 7.5 MHz and at 5 MHz. The benchmarks were a Sieve of Erastothenes program running under Z-BASIC and a global reformatting of a 39,552-byte WordStar file.

Problems

What? You mean that there might be problems? That's right, there might be, but they aren't very frequent, and they usually aren't much trouble. Briefly, any problems, other than those caused by a defective ZS100, can be expressed in terms of two factors: troubles running at high speed; and fiddling with the switch when you shouldn't.

There are a few '100s that simply will not run at high speed. For a couple of reasons, there will be no economical solution to their inability to run faster. If you have one of these, C.D.R. will refund your purchase price. Last year, C.D.R. said they had fewer than ten of those.

The most common problem with running faster comes with a slow 8088 CPU chip. Some of the earlier versions of this chip simply will not run very fast.

C.D.R. says that you can usually identify '100s with this problem. These units may have an Intel 8088 with a date of 1978 on them; or they have an 8088 chip made by NEC.

CPU chips by Intel with the date designation of "78-81" will generally run just fine; as will AMD chips with the 8088-2 designation. A new 8088 will cost you about 30 dollars if the one you have is too slow.

Most of the other problems are with the Z205 memory boards; you should check to see that you have 150-nanosecond chips. You may have to set them at one wait state to handle the higher speed. (Slower chips in the video memory won't cause any problem.)

Some people feel that Heath/Zenith started using slower memory and CPU chips somewhere along the line. Reportedly, you can be warned of possible trouble by a serial number starting with 349 or higher. (Also, some S-100 boards will have an LS-244 chip that causes trouble.)

Generally, the cost involved in replacing chips is worth the speed increase; but if you feel that the cost will exceed the benefits, C.D.R. will give you a refund.

There is little if any adverse reaction by the software, with one exception. ZSTEM, a communications program, reported a synchronization error at the higher speed.

Hoyle & Hoyle's Shuttle Lander also had visible effects, but positive ones; they were restricted to reducing the time between screen updates. The program itself ran as it should have.

For the most part, the only noticeable change is that a program will run about half again as fast.

Documentation

The documentation for the ZS100 is a 24-page paperback pamphlet that gives complete installation and troubleshooting instructions. Considering that actual use of the ZS100 is transparent to the user (except for the speed increase), there is little to write about. There is a complete table of contents, but no index. Of course, an index is hardly needed in so short a book.

Despite its brevity, the manual is entirely capable of leading you through the installation and use of the ZS100. If the module does not work, the troubleshooting guide will lead you through the most likely reasons for the problem. (A schematic is not included with this device.)

Conclusions

This is one of those products that was very much a joy to test. It did exactly what it was intended to do, and did it exactly as predicted. I had no problems at all with the ZS100; and neither did either of two machines at work.

In every case, the installation went exactly as the manual said it should. To make matters more pleasant, the module performed exactly as the manual said it would. For me, at least, this was a flawless performance.

Ordering Information

ZS100, $49.95. (Available at local Heath/Zenith Computers and Electronics and Zenith Data Systems dealers.)
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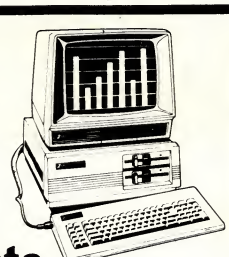

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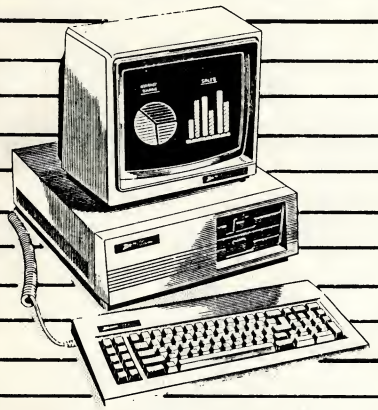

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CHUGCON '84— Back for More

The third Capital Heath Users' Group Conference was the biggest and best yet.

Mark Goodkin

The third annual Capital Heath Users' Group Conference, CHUGCON 84, was held on Saturday, November 3 in Arlington, Virginia. The entire staff of *Sextant* attended the event.

The conference was packed by midmorning. I heard later that over 2,000 people attended it. That's more than the first two CHUGCONs combined.

But one thing hadn't changed—the enthusiasm. In the seminars I attended, many people in the audience took part in questions and answers. In the exhibit hall, most vendors found people gathered around their displays. And at both meals—the luncheon and the evening banquet—people were eager to meet one another.

Aside from the meals, everything at the conference was free—the seminars, exhibits, and swapmeet. CHUG footed the bill.

CHUG also chose knowledgeable speakers. The caliber of the speakers and the well thought out questions from the audience made the seminars enlightening.

But one thing about the seminars bothered me—I couldn't attend all of them.

Scheduling seminars

One decision conference organizers must make is whether to let seminars compete with one another. Organizers of CHUGCON 84 ran them three at a time.

During the morning session, I attended Bill Johnson's lecture, "Genealogy and Computers." Running at the same time were Terry Groff's lecture, "Introduction to Lotus 1-2-3," and Glenn Roberts' "C Language." I would have liked to attend these lectures, too.

In contrast, the lectures at the Western Regional HUG Conference held in November ran one at a time. I was glad to know that I could attend as many of these as I wanted to. (See the article on the Western Regional HUG conference elsewhere in this issue.)

But CHUGCON's approach—having lectures compete—also has advantages. For one thing, more lectures can fit into a conference. The Air Force Small Computer Conference in October ran several of them at a time. This let them schedule over 100 seminars and workshops in four days. (See "Heath/Zenith Dominates Air Force Small Computer Conference," in *Sextant* #15, March-April 1985.)

This approach works better for large conferences; the single-file approach works better for small ones. It was good to have lectures in single file at the Western Regional HUG Conference, which drew 630 people. But I can just see it used at CHUGCON 84, with 2,000 people crammed in for a lecture!

Genealogy in the morning

Bill Johnson, who lectured on genealogy and computers, was the founder and first president of CHUG. He sits on the Governing Council of the National Genealogical Society and chairs its Computer Interest Group.

Johnson's session began at 8:30 a.m., when not many people had yet arrived for the conference. So just a handful of people attended his lecture. The Western Regional HUG Conference shared the same plight of poor morning attendance. By midmorning, attendence at both conferences picked up.

Johnson began his session by explaining the importance of computers to genealogists. "It's a very exciting time in genealogy," he said, "because computers offer so much potential." He explained, for instance, the time-saving value of a data base for maintaining a family tree.

Johnson described the hardware requirements of computer genealogy. He said that you can get by with an 8-bit computer such as an H8 or H/Z89. But your computer will need as much memory as possible since genealogy records can quickly take up space.

His discussion of genealogy software included Commsoft's ROOTS. Two versions are available to run on Heath/Zenith computers. H8s and H89s can run ROOTS/M under CP/M or ROOTS89 under the Heath Disk Operating System (HDOS). Z100s can run the new ROOTS II under the Zenith Disk Operating System (Z-DOS). (See "ROOTS Gets the Family Into Your Computer," in *Sextant* #15, March-April 1985.)

ROOTS II has some advantages over the earlier ROOTS. For one thing, its storage has been expanded to hold 4,096 records. In addition, it can download text from your word processor. This saves you from having to retype text into ROOTS II directly.

After discussing software, Bill emphasized the importance of support to genealogy. For the beginning genealogist, he recommended the magazine *Genealogical Computing*, published by Paul and Sarah Andereck out of Fairfax, Virginia.

But he warned that the magazine is written for computers in general—not for Heath/Zenith machines specifically. So you may have difficulty finding articles which apply to Heath/Zenith computers.

Cogswell and Stetson on MS-DOS 2.0

The lecture on MS-DOS 2.0 drew a large crowd. Mike Cogswell, one of the speakers, is technical director of the Air Engineering Division at Mantech International. He's also a former president of CHUG. The other speaker, John Stetson, is a project manager with General Electric Corporation. He's been with CHUG for five years now, and was for a while its software chairman.

Cogswell started off the session with a quick history of the Microsoft Disk Operating System (MS-DOS). He recognized the disappointment many users had felt when they ran the operating system on new 16-bit computers like the H/Z100 and the IBM Personal Computer. Although MS-DOS 1.1 runs on 16-bit machines, it "wasn't much of an upgrade over [8-bit] CP/M."

After Intel's 8088 central processor was chosen for the IBM Personal Computer, IBM went shopping for an operating system to run on it, Cogswell said. They eventually went to Microsoft; and "Microsoft said, 'Yes, sure, we can do it!'—in the grand tradition of all salespeople—and quickly set about trying to find somebody who already had an operating system."

That company turned out to be a

small company up in Seattle, Seattle Computer Products. "It was the first to develop an S-100 card to use the 8088 chip," Cogswell said. "And in order to use that as a computer, other than just an interesting hardware exercise, they needed an operating system. One of their engineers developed rather quickly an operating system that would run on that chip—based to some degree on CP/M. He originally called it QD-DOS for Quick and Dirty DOS."

Microsoft "quickly acquired both the operating system and the engineer who wrote it."

That original version of the operating system had been "thrown together in somewhat of a rush," he said. "Unfortunately, we still live to this day with some of its limitations."

Some of the bugs and other problems were corrected in early releases of MS-DOS version 1. Zenith then put version 1 on the Z100—calling it the Zenith Disk Operating System (Z-DOS). However, it still had many of the limitations of the much older 8-bit system, CP/M, to which it was still "largely similar."

It has only been with version 2 that MS-DOS has started to live up to its potential as a 16-bit operating system. Stetson took the microphone to explain some of the main differences between version 1 and version 2.

He explained how users can take advantage of the more powerful features of MS-DOS 2.0 in four areas: the command interpreter; hierarchical directories; input/output; and using Winchester disk drives.

Computers and the law

Of those lectures I attended, the most interesting one to me was "Legal Aspects of Microcomputing—Contract Law, Copyrights & Warranties." The speaker, John Weld, is an attorney with the Computer Law Center in Washington, D.C.

Weld began by discussing the challenge that computer law presents to lawyers. The legal system, he said, usually lags from one to two generations behind technology. Therefore, "we as lawyers are always trying to catch up with the latest wrinkles and the latest innovations in the computer field."

Much of his talk focussed on hardware and software warranties from a consumer's point of view. The major point was that consumer rights are ignored in both hardware and software warranties. "If I have a one-sentence description," he said, "it is: 'If something goes wrong, dear buyer, *you're stuck*.'"

He read a warranty on some Apple software as a typical example of software warranties. This warranty, he said, covers the software and documentation manual for "physical defects." In other words, the warranty covers just the physical disk (not the program itself), and covers the paper of the manual (not the information).

But he added that Maine, Maryland, California, and Connecticut have consumer-protection statutes, which give consumers some protection on warranties. It's been his experience, though, that most consumers are unaware of these protection statutes.

You may think that the small amount of protection for consumers is bad enough, he said. In fact, businesses have *less* protection. The law assumes that, when purchasing, a business will be "just as sophisticated" as a seller, he said. "Therefore if something goes wrong, *too bad*." But, he said, "an awful lot of businesses ... really don't know how to buy software and hardware intelligently yet."

John Weld's associate, Karen Keeney, a specialist in copyright law, pointed out the steps software developers should follow for giving notice of copyright on their products. "Do a C in a circle with your name and the date. And they're really technical about it," she said. "There's been a case where someone had a C in parentheses and they said, 'that's not good enough.'" The other way to give notice is to spell out "copyright" (or abbreviate it, "copr."), with your name and the date.

On the exhibit floor

Like this year's overall attendance, the number of vendors at this year's conference surpassed that of each of the first two years. Nearly 40 vendors came this year, an increase over the 22 who came the first year and 30 the second year.

One vendor represented at this year's conference has been bucking a major trend. As more companies turn toward the Z100 and Z150, Trionyx Electronics, Inc., of Santa Barbara, California, still has its eyes on the H8. They're planning an upgrade to bring the machine to 16-bit operation, though they haven't announced when it will be out.

Another vendor, P. E. Systems, Inc. of Alexandria, Virginia, has been supporting the '100 and '150 with encryption products. According to one of their sales representatives, Jeanne Wilgus, they've done their business mostly with the government, especially the military services. But they want to expand. "We're ... testing the market right now with hobbyists."

If you ever wanted to be an astronaut, you may be interested in Shuttle Lander, exhibited by Hoyle & Hoyle Software. According to Janet Hoyle, the Shuttle flight-simulator program duplicates the main instrument panel of the real Space Shuttle.

The program's authors are Dr. Terry

EMULATE

A program which allows the H89 to read/write to the following disk formats.

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Osborne 1	SSDD	Morrow MD3	DSDD	Cromemco	DSDD
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Xerox 820	SSDD	Televideo 802	DSDD	CDR 80TK	DSXD
DEC VT180	SSDD	Actrix	SSDD	NEC 8001	SSDD
Ampro	SSDD	TRS80/Omikron	SSSD	Eagle II	SSDD
DEC Rainbow	SSDD	TRS80-4 CP/M	SSDD	Z100 40TK	DSDD

A universal format program will be supplied as a free update. The H37 version requires 64K of RAM and the use of a modified version of CP/M 2.2.03 or .04 BIOS which is included with the program. Allows the use of virtual drives and reading of 40 track disks in an 80 track drive.

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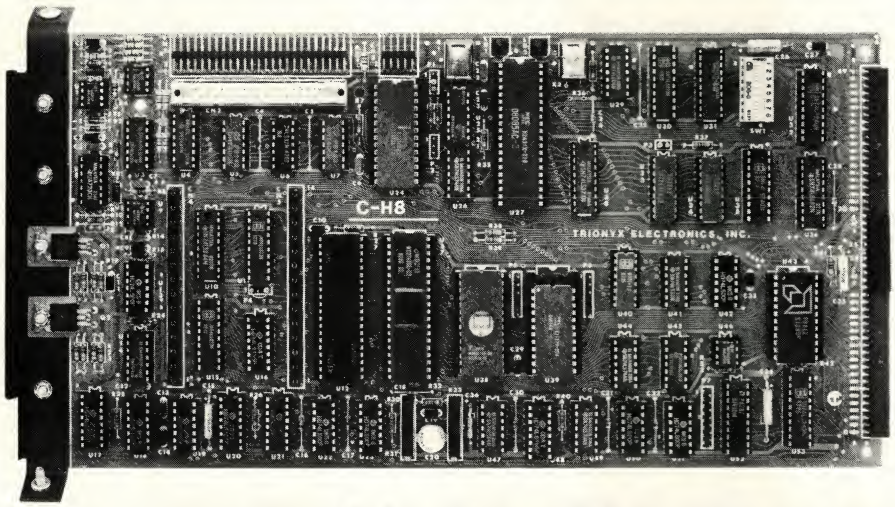

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Groff and his brother Warren, both of Groffics Innovative Graphic Software. They have designed Shuttle Lander so that you can land it like the real thing. If you foul up at the controls and crash, the program will tell you that you've been "blown to smithereens." (Using the software changed her life, Hoyle said. It gave her enough confidence to fly a real airplane.)

Just across the aisle from the Hoyle & Hoyle exhibit was a swapmeet table. People were there trying to either sell or barter away their used computers and computer paraphernalia. One man told me he was selling his HERO I robot to buy a HERO Jr. Two years ago, he bought the HERO I for his children. But he now feels that it's too complicated for them. He thinks they'll make better use of HERO Jr.

Those in the exhibit hall were probably wondering what all the shouting was about in the next room. It was an auction conducted by the Heathkit store of Alexandria, Virginia. HUGgies gathered around a row of tables looking on as auctioneers sold computers, modems, drives, terminals, and software to the highest bidders.

Encryption at lunch

At noon, aside from a few CHUGgies guarding the exhibit hall, just about everybody went to the luncheon.

The luncheon's first speaker was John Guenther, a member of the evaluation team for the Air Force Small Computer Program. Guenther talked about the recent Tempest contract for the Z150. (To meet the Tempest requirements, a computer must not emit any electromagnetic radiation from which information can be picked up.)

He explained why the Air Force and Navy chose the '150 for their Tempest contract. One reason was the way the computer was kept secure. "It's not in a lead box. It doesn't weigh 500 pounds. It doesn't have all kinds of fancy doors and windows on it to shield it."

If you foul up at the controls and crash, the program will tell you that you've been "blown to smithereens."

He explained also why the Air Force and Navy had earlier contracted for a standard small computer (the Z100) for their general use. It began in 1982 when the Air Force saw that everybody was buying their own microcomputers and software. "They were going out and buying them in ones and twos and threes," he said. So they wound up paying the list price for hardware and software.

Another problem was incompatibility. "They weren't getting configurations that were beneficial to more than just one small area of the Air Force."

Guenther said the Air Force is pleased with its Z100 contract with Zenith. So far, they've bought 17,000—three times the number estimated in the contract. On top of that, Air Force people keep on discovering new applications for the '100. They're using it, he said, in "every place that you could possibly imagine."

The second luncheon speaker, William Barker of P. E. Systems, Inc., talked about computer encryption.

Barker first discussed the choice between software and hardware encryption. Your choice, he said, depends on what you want it for. "It's a matter of tradeoffs." Dedicated or specifically designed hardware is more secure and usually easier to work with than encryption software on an ordinary computer. But the hardware is more expensive and harder to maintain.

Explaining why you'd encrypt information at all, he said that the military does it to protect classified information. Businesses do it to conceal information

Exhibitors at CHUGCON 84

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from their competitors. And individuals do it, he said, for things ranging from "husbands thinking it would be nice to protect the little black book they put on their computer, to people that would not like the IRS to read exactly what they did in automating their taxes last year."

Following Barker's talk, Mike Supley, president of CHUG, presented CHUG's new publication, *The Best of CHUG*. CHUG was selling them for five dollars each—which is less than their printing cost. In addition, they had printed only 500, which prompted Supley to warn, "When they're gone, *they're gone*."

Deflating rumors at dinner

It's hard to say which meal—the luncheon or dinner banquet—was better. They were both excellent. The keynote speaker at dinner was Ron Hackney, the new product manager of Zenith Data Systems. Hackney spent part of his talk addressing "some rumors in print." He was referring to Charles Floto's editorial in *Sextant* #13 which said that "complaints, discontents, and fears abound" in the Heath/Zenith user community. Before addressing these rumors, Hackney joked, "You taking notes C.F.?—there *will* be a quiz."

One complaint he addressed was that Zenith is selling its version of MS-DOS for $150 while IBM is selling its own for just $65. He said, "What is not mentioned is the fact that MS-DOS is included free with each [Heath/Zenith] computer sold."

He next discussed the expectation that Zenith will phase out Heath Company. "There is simply no truth to this allegation," he assured the audience. "Heath is a profitable company, and there are no plans of any type to phase it out." He said that it would be economically unsound for Zenith to convert its building from manufacturing Heathkits to turning out assembled products.

The next rumor Hackney addressed was whether Zenith might sell its Heathkit Electronic Centers. "Wrong again!" he said. Recently, Zenith changed the name of its Heathkit stores to Heath/Zenith Computers and Electronics. In addition, he said, they have allocated $70,000 to each store in North America for remodelling. "This would not be done if we were going to sell the stores."

After his formal talk, someone asked him what product development was underway at Zenith Data Systems. He repeated the familiar Zenith line that he wasn't allowed to talk about it.

At my table, we had a pleasant visitor—HERO Jr. He asked the man seated next to me, "Are you a person?" After the man said yes, Junior went to another table.

While HERO Jr. was visiting people, Bob Ellerton, manager of national HUG, announced the winners of the door prizes. Vendors had donated over 75 door prizes to be given away at lunch and dinner. The grand prize given away at dinner was a Z161. It was donated by Veritechnology Electronics Corporation, the Zenith subsidiary that runs Heathkit stores.

Some reflections from CHUG leaders

Mike Supley told me that he was pleased with the number of military personnel who had gone out of their way to attend the conference. "We've... got a number of people who have taken their vacation times ... with the military to come in to this conference."

Speaking from experience, Supley gave a tip to other Heath Users' Groups wanting to put on their own conferences. Break up into subcommittees, he said, and have the committee heads form a steering committee. "That moves the action really down to the people who are doing things as opposed to having it [all] at the chair level."

Supley commended John Roach, who chaired this year's CHUGCON, for an outstanding job. Supley said, "Thank God it's not long distance between his house and mine for phone calls."

Roach said that putting on a conference is "comparable to running a zoo when you've run out of Purina Cat Chow. I'd recommend it to anybody else—so I don't have to do it again. But in all honesty, it is a lot of fun."

Roach wasn't the only one who enjoyed the conference. Many attendees and vendors also enjoyed it and will be pleased to know 1985's CHUGCON will run two days—November 2–3. Seeing how the quality of each succeeding CHUGCON has surpassed that of the one before, it will be interesting to see how CHUGCON 85 exceeds CHUGCON 84.

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Great Graphics on the '19 and '89

Imaginator and Illustrator team up to bring high-resolution graphics to your screen.

Karen D. Morton and Walter M. Scott, III

Have you ever wanted high-resolution graphics for your H/Z89 or H19?

There are several replacement character-generator read-only memory (ROM) chips available; but they have medium resolution (typically 125 vertical x 160 horizontal pixels) and little software support. Also, it is difficult to print out the graphics image; you need a specially written screen-dump program to do so. An ordinary '89 screen dump simply tells the printer what characters are on the screen; it doesn't go to your substitute ROM to find out what they really look like.

Color graphics boards are also available; but they require the use of an external monitor or television. The resolution of these boards is also medium (usually 256 x 192 pixels). And hardcopy may be difficult to obtain since the screen-dump program must be written for the particular board.

With the graphics system described in this article, you can draw high-resolution graphics (247 by 504 pixels) on your '89's present screen. The hardware portion of this system is an intelligent graphics board called the Imaginator I-100, from Cleveland Codonics. You can get it in kit form for $395, and the assembled version for $445.

The software portion of the system is a program called the Illustrator, from WIzard Software House of Providence, Rhode Island. It costs $89.95 and runs under either CP/M or the Heath Disk Operating System (HDOS). (The Illustrator was formerly called Wiz-A-Graph.) A version of the Illustrator is also available for the Z100 under the Zenith Disk Operating System (Z-DOS). No additional hardware is needed on the Z100.

Putting the Imaginator together with the Illustrator allows you to create, edit, store, and print hardcopies of graphic images. And files created by the Illustrator can be accessed by other programs.

For hardcopy, you require a printer with bit-image graphics capability, such as the Epson RX-80.

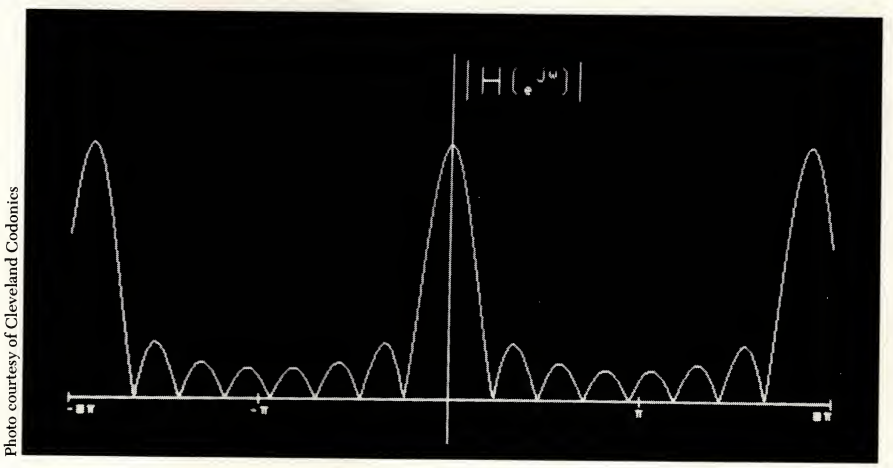


Photo courtesy of Cleveland Codonics

(Graphics-Plus 19, a board similar to the Imaginator, is available from Northwest Digital Systems of Seattle, Washington. It claims slightly higher resolution—250 x 512—and more built-in features than the Imaginator. However, it is nearly twice the price. Another board, with which we're not familiar, is offered by SigmaSoft and Systems of Dallas, Texas. It has 250 x 640 resolution and costs $495.)

The hardware—what it does

The Imaginator board has the following features:

1. It uses the Z80 microprocessor on the '89's (and '19's) terminal logic board to perform graphics processing independent of the computer's central-processing unit (CPU).

2. Graphics commands can be entered directly from the keyboard (with the terminal or computer "off line") or via software. The board can be programmed in any language.

3. Commands entered from software may be either in ordinary ASCII characters or in machine-readable (binary) form.

4. Imaginator operation is transparent. All normal functions of the '19 and '89 are unaffected. The normal Heath display, including Heath graphics, can be combined with the Imaginator's high-resolution display. Each display can be controlled independently, including turning each one on or off.

5. Graphics data can be read directly from random-access memory (RAM) on the Imaginator board. This allows graphics images to be stored, printed, etc.

6. A socket is provided for memory expansion. Up to 16 kilobytes of RAM or ROM can be plugged in and accessed by the board. Custom programs can use this memory for advanced graphics techniques.

7. An optional ROM allows an Imaginator-equipped '19 or '89 to emulate a Tektronix 4010-4014-series graphics terminal. This option can be used with mainframe packages such as PLOT-10.

You can buy the Imaginator as either a completely assembled board, a kit, or a bare board.

Putting it in

Before installing the Imaginator board in an '89 or '19, two chips must be removed from the terminal logic board (TLB) and plugged into the Imaginator. These are U474 (a 74LS166 digital-logic decoder) and U421 (the Z80 microprocessor). Two pre-assembled jumper cables are installed between the Imaginator and the sockets on the TLB vacated by these chips. A power harness, which must be partially assembled, is installed as well. (No soldering is

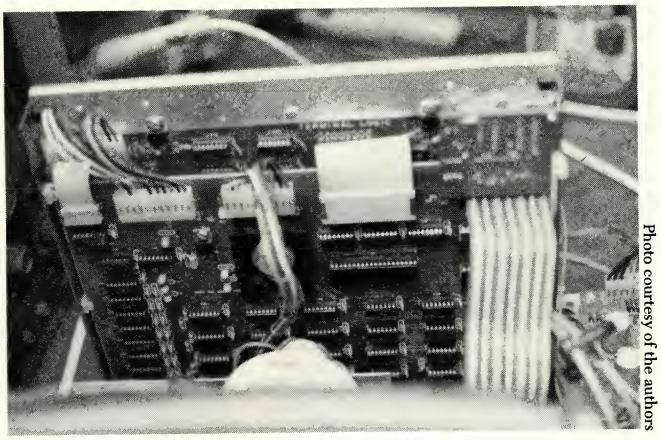


Photo courtesy of the authors

Figure 1. The Imaginator board installed in an H/Z19. It occupies the space that the CPU board would occupy in an H/Z89.

required for these jobs.)

For '19 owners, installation of the completed board is relatively simple. It slides into the slot where the CPU board would go if you had an '89. (See Figure 1.)

Installation into the '89 is more difficult. (It is secured lying flat over the tops of all the other boards inside the '89. See Figure 2.) But the Imaginator manual does a very good job of explaining installation. It is written in the same style as the Heathkit assembly manuals.

However, the manual does fall short in a few areas. Although it briefly mentions a possible handshaking problem, it does not go into detail. The Imaginator is designed for *hardware* handshaking, where a particular communications line is used to signal whether it can accept data or not.

Unfortunately, the TLB and the CPU in an '89 normally communicate by XON/XOFF *software* handshaking. (So when the TLB's communication buffer is full, it sends a control-S—stop output—to the CPU. When the TLB can accept further data, it sends a control-Q—resume output—to the CPU.)

With small amounts of data, and at slow speeds, there should be little problem from the lack of compatible handshaking between the Imaginator and the CPU. The board's buffer should be large enough, or emptied fast enough, to handle the data. But some data may be lost when the CPU sends large amounts of data at high speeds. (The Imaginator causes the terminal to beep if this happens.)

Fortunately, the '89 already contains everything necessary for hardware handshaking. Upon request, Cleveland Codonics will send you detailed information on modifying the operating system (HDOS or CP/M) to accept hardware handshaking. This modification does not affect the normal operation of the computer in any way.

This modification also applies to an H8 computer interfaced to the '19 through an H8-4 serial card. (Cleveland Codonics does not support the H8-5.) However, you must ensure that pins 1 through 8 and pin 20 of the RS232 connectors on the '19 are connected with the corresponding pins on the '8's RS232 connectors. The best way to ensure this is to use the standard Heath cable.

For slow languages such as BASIC, the hardware-handshaking modifications are not required. However, to run the Illustrator on an H8, the pin connections must be made.

A couple of cautions

Once the board is installed, the manual describes several tests that check to see if the Imaginator is functioning properly. In one test, you set the board's height control. There, the manual asks you to draw a filled rectangle on the screen and then adjust the video display's height control until the rectangle is a perfect square. That's what you should do if you are using the board without the Illustrator.

If you are using the Illustrator, however, the display controls should be adjusted until the rectangle is 5⅞ inches high by 3¼ inches wide. (This yields three vertical pixels per horizontal pixel as the best aspect ratio for a circle, and shows the best circle on printout.)

Also, the manual fails to mention that installation of the Imaginator may silence the terminal's beep at power-up. Thus, the '89 beeps only once, and the '19 does not beep. All other functions of either machine are normal with the Imaginator installed.

Imaginator's commands

The Imaginator uses the following commands (keyboard input is indicated in parentheses):

Enter Graphics Mode (ESC 1 <CR>) enables Imaginator board.

Move to (Mx,y <CR>) moves Imaginator cursor to coordinates x and y.

Point at (Px,y <CR>) prints a pixel at location x,y.

Line to (Lx,y <CR>) draws a line from the current position to a new x,y location.

Set line style (Nz <CR>). The line style, or pattern, is repeated every eight pixels. The pattern of the pixels corresponds to the binary value of "z". Each "1" turns a pixel on; each "0" turns a pixel off. This creates 255 different line styles. So, z=0 draws an invisible line; z=255 draws a solid line; and the numbers in between draw all the other sequences possible (not all of which will look different).

Area to (Ax,y <CR>) fills the rectangle defined by the cursor and x,y (as its diagonal) with the current line style and line type.

Set line type (Iw <CR>). The letter "w" represents an integer from 0 to 5: "0" turns the line on; "1" turns it off; "2" turns on each pixel that was off, and vice versa; "3" reads each pixel in a line and sends an ASCII 0 to the computer if the pixel is off, an ASCII 1 if it is on; "4" is used to change to a secondary line style at a boundary; "5" is similar to "3", except that the line is read eight pixels at a time.

Display toggle (Dv <CR>). The letter "v" represents an integer from 0 to 7. Each of the three binary digits that make up this integer acts as an on/off switch. The most significant enables the Heath display; the middle digit enables the Imaginator display; and the least significant erases the Imaginator display.

These commands, along with other less frequently used commands, are fully explained in the manual. The manual also contains several good example programs.

Unfortunately, the Imaginator itself does not support any commands for generating circles or curves. Without something like the Illustrator, these must be programmed pixel by pixel by the user.

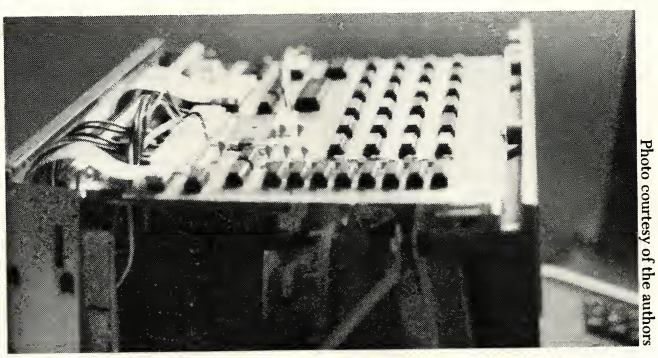


Photo courtesy of the authors

Figure 2. The Imaginator board installed in an H/Z89.

Programming the Imaginator board

Programming the board can be an interesting experience. For example, we recently wrote a program in Microsoft BASIC to plot and display a graph of the frequency response of a loudspeaker. This program combined standard Heath graphics with the Imaginator. The combination created an excellent graph.

There were, however, a few problems.

Placing pixels in specific areas of the screen was difficult. Using the keyboard to enter Imaginator's "point at," "move to," and "line to" commands directly to the board helped a lot. The origin (0,0) of the Imaginator is in the lower left corner of the screen. However, compared to the left margin of the Heath display, the left edge of the Imaginator display is indented to the right.

We have also written an MBASIC program to dump the Imaginator screen to an Epson printer. (See Listing 1.) This routine has some limitations, but it verifies that graphics information is easily obtained from the board.

Although the Imaginator can be programmed in any language, a dedicated software package is required to generate graphic displays easily.

```
10 'IMAGINATOR SCREEN DUMP
20 'prints 240 pixels across & 504 deep
30 DEFINTA-Z
40 OPEN"O",1,"LP:"
45 PRINT#1,STRING$(13,10)
50 PRINTCHR$(27);"1";"15"
60 PRINT#1,CHR$(27);"1";  'set graphics spacing
70 FORX=496 TO 0 STEP-8
75 PRINT#1,TAB(20);
80 PRINT#1,CHR$(27);"K";CHR$(240);CHR$(0);   'printer into graphics mode
90 FORY=240 TO 0 STEP-1
100 PRINT"P";X;Y
110 A$=INPUT$(3):D=VAL("&H"+A$)
120 PRINT#1,CHR$(D); 'print graphics data
130 NEXT
140 PRINT#1,
150 NEXT
160 CLOSE
170 PRINT"D6,EDONE!!!"
180 PRINTCHR$(7):GOTO180
```

Listing 1. A short MBASIC test program to dump the Imaginator screen to an Epson printer.

The Illustrator

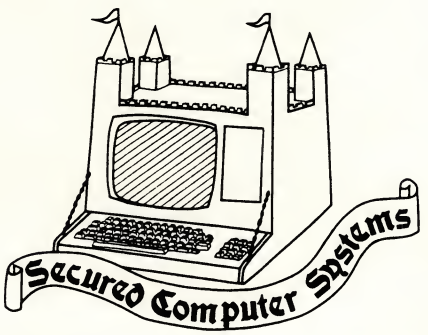
The Illustrator is a software package that makes graphics on the Imaginator easy to draw.

A much, much more expensive ($399) program is available from Cleveland Codonics. This program, called Plotware-z, is available on 8-inch disk only, runs under CP/M, and requires the Tektronix-emulator ROM mentioned above.

The Illustrator will run under either HDOS or CP/M, as noted above. It requires 56K RAM and an H8/19 or '89 with Imaginator installed.

The Illustrator will also run under Z-DOS on an H/Z100—without Imaginator. (The Z-DOS version has some commands the other versions do not have—primarily for dealing with color.) The HDOS and Z-DOS versions of this program are also available from Newline Software of Tiverton, Rhode Island.

The Illustrator is a 103-sector program, written and compiled in C. It comes with a serial printer driver and some sample graph files. (*Note:* The type of printer you will be using must be specified when ordering. The Illustrator will support most graphics printers.)



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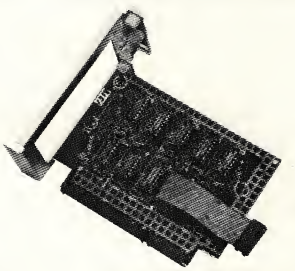

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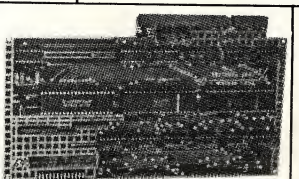

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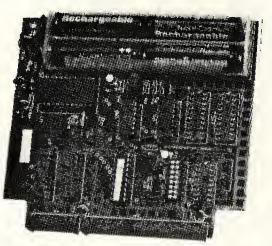

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Main Keyboard Commands

Command	Description
F	Speed up cursor fast (+5 pixels/keystroke)
f	Speed up cursor slow (+1 pixel/keystroke)
S	Slow down cursor fast (−5 pixels/keystroke)
s	Slow down cursor slow (−1 pixel/keystroke)
R	Toggle rubber-band mode on/off
r	Reverse cursors
T	Tag area for copy
t	Toggle turtle graphics mode on/off
L/l	Locate to (x,y)
M/m	Change mode (On, Off, Invert, or Complementary)
C	Clear screen
c	Cursor on/off
H	Help (toggle command list)
h	Toggle status list at top of screen
'	Enter alpha mode (normal characters)
"	Enter alpha mode (italics)
' or " plus ^	Print alpha characters vertically toward top of screen
Control-D/d	Exit alpha mode
E	Erase (doesn't reset cursor)
e	Erase (resets cursor)
W	Draw (doesn't reset cursor)
w	Draw (resets cursor)
B	Box fill
b	Draw box
O	Circle (or ellipse) fill
o	Draw circle or ellipse
D	Diamond fill
d	Draw diamond
P	Print tagged area
p	Print whole screen
V	Save tagged area (to disk)
v	Save whole screen (to disk)
G	Restore image (from disk) at (x,y)
g	Restore image (from disk) at (0,0)
Control-R/r	Inverse video (whole screen)
Control-E/e	Exit from Illustrator

Keypad Commands

Cursor controls:

7 Up left	8 Up	9 Up right
4 Left	5 Home*	6 Right
1 Down left	2 Down	3 Down right

*Home brings the + cursor onto the diamond cursor

Other controls:

0 Define circle aspect ratio
. Define line pattern

Table 1. Most of Illustrator's commands are defined by a single keystroke.

What's on the screen

When the Illustrator is run, the first thing that appears on your screen is a menu. Don't worry about trying to memorize the commands; a copy of the menu appears in the documentation. Just remember that an "H" will print the menu on the screen if you get stuck. It takes another "H" to return you to the drawing board. The menu will remain on your screen for a short time—do not type anything until it disappears.

Once the menu disappears, the drawing board comes up on the screen. The cursors (a little diamond and a "+") can be placed in three different modes: turtle, rubber band, or off. The turtle mode is turned on by typing a "t". An "R" turns on the rubber-band mode. To make the cursors invisible, type a "c". (When "invisible," lines are still stored in memory, and they can later be turned on for display.)

In the rubber-band mode, both cursors are used. The main cursor (the diamond) moves, and the second cursor (the "+") remains at the original cursor position. This mode allows you to see what a line looks like before you permanently draw it in place.

The turtle mode uses one cursor. You can draw lines in eight directions. Finally, the cursors can be maneuvered with both the rubber band and turtle modes off. No lines are drawn. (This is useful to move the cursors to a mistake in order to erase it.)

One-key commands allow you to draw certain shapes such as boxes or circles. A "b" draws a box from the diagonal points of the two cursors. A "d" draws a diamond with its center at the cross cursor. (The "radius" is the difference in the x direction between the cross cursor and the diamond cursor.) And an "o" draws a circle.

(Before you can draw a circle, you must enter the aspect ratio—vertical to horizontal pixels. This is done by pressing the "0" on the numeric keypad and then typing in your numbers. The best circle is achieved using "3,1". All other combinations draw ellipses.)

Typing the capitals of these letters causes the figures to be filled with any of the 255 different line patterns mentioned above. The Illustrator allows you to define the primary eight-pixel line pattern by typing in periods (pixel on) and spaces (pixel off).

The numeric keypad on your '89 or '19 controls the direction of movement. Besides using the arrow keys to move vertically and horizontally, you can also use the keypad to move diagonally. For example, the "7" on the keypad causes the main cursor to move to the upper left. The other keys are: 1, lower left; 3, lower right; 9, upper right.

The Illustrator also has three different line modes (on, off, and inverse) which you can set with the "M/m" key. You can also move the cursor with the "L/l" key. The cursor speed can be set from 1 to 65 pixels per keystroke by using the "S/s" (slower) or "F/f" (faster) keys. (See Table 1 for a complete list of Illustrator commands.)

You can also type letters on the screen in four different modes by using three keys: the apostrophe ('), the quote ("), and the SHIFT-6, the caret (^) key. The apostrophe takes you into the alphabetic mode with regular characters; the quote takes you into alpha mode with italic characters. To write vertically up the screen with regular letters, type an apostrophe and a caret. To write vertically in italics, type a quote and a caret.

There is one drawback, however. When typing in the vertical mode, the backspace key will *not* get rid of typos. To solve that problem, a control-D will get you out of alpha mode and back into the graphics mode. Then you can go into regular (horizontal) alpha mode, and retype your goof.

Saving it to disk

The Illustrator can send part or all of the screen to disk or printer. You can also retrieve an image from disk and position it anywhere on the screen. The Illustrator can also copy an image from one part of the screen to any other part—and tip it upside down or give a

mirror image in the process.

Saving a picture to disk or printer takes around five minutes. This is because the computer must process up to 124,488 (247 x 504) pixels of information sent from Imaginator to memory or to the peripheral. In this case, patience is a virtue!

However, the graphics files created by the Illustrator are small; a full screen display typically requires only 20 sectors. The files are read in by the Illustrator much faster than they are written, usually in less than ninety seconds. Illustrator files can also be used by any other programs that support the Imaginator board.

Some bugs?

We ran into a few minor problems in getting a hardcopy of a graphics display prepared by the Illustrator. It is a good idea to save the file to disk before attempting a printout, in case anything happens.

One problem we have had is that the program cuts off the rightmost twenty pixels of the display when making a hardcopy. To avoid this, don't place anything near the extreme right edge of the screen. (Twenty pixels is approximately ⅛ inch.)

Also, after the Illustrator has made one printout, it will inquire if you wish another one. If you answer "yes," the program may hang up; all you can do is reset and reboot. To avoid this problem, answer "no," then select "p" for another printout when the menu appears.

Another problem is in printing information located in the lower-right corner of the display. Sometimes part of this information is apparently left in a buffer. To extract it (and complete your printout), answer "yes" to "another printout." The printer will then complete your picture.

After you have exited from the Illustrator, it leaves the Imaginator display intact. This can be useful. For example, you can exit the Illustrator (perhaps to change disks), then re-enter the program with the picture still in the Imaginator's memory. On the other hand, this can leave the screen looking very cluttered. To eliminate the clutter, use SHIFT-RESET or ESCape z to clear the screen.

The biggest problem of all: the Illustrator's documentation is very poor! The instructions are not easy to follow, and some features were left out. (WIzard Software House states that revised documentation is on the way.)

And so...

The Imaginator board plus the Illustrator is one of the easiest ways to get sophisticated high-resolution graphics for your beloved '89 or '19.

Using the Illustrator, you can also make pictures on your printer. In short, you can find many uses for the graphics you create with the Imaginator.

Ordering Information

Imaginator graphics board; bare board and documentation, $215; kit, $395; assembled and tested, $445.
Plotware-z (CP/M, 8" format), $399.
Cleveland Codonics, Inc.
18001 Englewood
Cleveland, OH 44130
216/243-1198

Illustrator Graphics Design Package (HDOS, CP/M, Z-DOS), $89.95.
WIzard Software House
79 Marshall Street
Providence, RI 02909
401/331-5034

Illustrator Graphics Design Package (HDOS, Z-DOS), $89.95.
Newline Software
P.O. Box 289
Tiverton, RI 02878
401/624-3322

Graphics-Plus 19, assembled and tested, $695.
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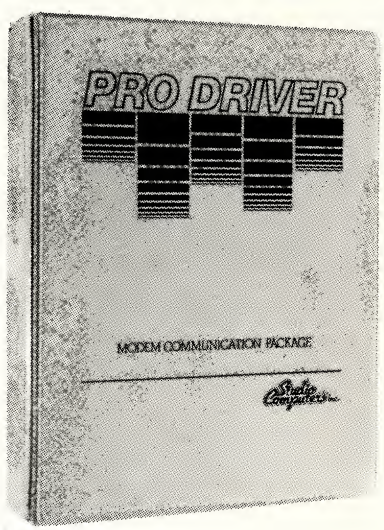

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20 A = 5
30 B = 10
40 C = A + B
50 PRINT C
```

And in fact, a lot of computing involves manipulating numbers and outputting numeric answers. However, one of the most powerful applications of computers—from micros to mainframes—is that of keeping track of things.

All of us make lists and keep records—for shopping, priorities, bills to pay, Christmas cards, phone numbers, address books, etc. Many have discovered that the microcomputer provides a powerful tool for record handling. It helps us create records, compare them for similarities and differences, sort them, index them, modify them, add to them, and combine them with other lists to make larger lists.

The "descriptor" which most have come to accept as the computer-age substitute for "record handling" is "data base management." And the program to do that job is a data base management system (DBMS). A lot of good programs have been developed for microcomputer data base management, including dBASE II, Condor, Query!, MDBS II, InfoStar, etc.

Some of them, in fact, are not merely DBMSs. dBASE II, for instance, actually contains a programming language. Using dBASE II commands, one can easily perform the basic tasks of record-making and maintenance by typing instructions, one at a time, at the keyboard. But, as many have discovered, you can also put together sets of instructions, or programs, for dBASE II. For example, complete accounting packages can be created using these programs—all within dBASE II.

However, with that strength comes a cost: it can be hard to learn, as well as expensive. Moreover, many of us don't really need a system as powerful as dBASE II. We mainly need a system that handles sets of records reliably, quickly, and in a "user-friendly" fashion. And ideally it should cost less than $600—a lot less!

If that is the sort of system you are looking for, then Jupiter may be the program you want. And it costs less than $600. At $49.95, it's a lot less!

Jupiter is a specialized DBMS offered by Powerline Systems of Lincroft, New Jersey. It runs on an H/Z89 with a minimum of 48 kilobytes of memory. It also requires two or three 5¼" or 8" floppy-disk drives, or a single hard disk. Jupiter runs under the CP/M operating system (version 2.2 or later) and requires a printer configured as the LST: device.

Jupiter does not, however, run on the H/Z110 or '120; nor on an H8 with the 8080 central-processor unit (CPU). The reason is that Jupiter uses code unique to the '89's Z80 CPU. This makes the program incompatible with the H/Z100's 8085 processor and the H8's 8080 CPU. (An H8 with a Z80 CPU will, however, run Jupiter properly.) A version for the H/Z150 and the IBM Personal Computer is under development, however, and one for the Z100 should follow.

A bit of background

Jupiter's author, John Preusse, describes it as a "high-performance records-management program." It is that, certainly.

I found Jupiter to be professionally written, well documented, user friendly, and apparently bug-free. It creates, sorts, modifies, and reports on a very large (or small) number of records efficiently and quickly. And, almost as a bonus, it generates mailing labels with ease.

A bit of background may help to establish perspective on this review and Jupiter's "pedigree." In December 1982, I purchased a copy of Powerline Systems' COUPON program for my wife. She was immediately "hooked," uses it regularly, and probably even saves some money in using discount coupons at the grocery and drug stores. (Among the shopping community in Northfield, Minnesota, she also achieved local notoriety as the "lady who grocery shops with a box of coupons and a computer printout.")

In helping her learn to use COUPON, I was taken with the program's quality, flexibility, elegance, and sophisticated data base management techniques. It really "works" coupon data—including product name, manufacturer, expiration date, and value. COUPON has speed, clean screen displays, and gives screen or printer outputs sorted on virtually *anything*. I thought a lot about modifying COUPON and using it for maintaining other data bases—basically because it is fast, simple, and useful.

Then came the second National Heath Users' Group Conference, in late summer 1983. Our company, Micro World Publishing, had a booth there. Whom should we meet while setting up our booth but John Preusse, COUPON's author. After we shared pleasantries with John about our fun with COUPON, he demonstrated Jupiter for us. Having experienced the power of COUPON, I was anxious to see what Jupiter could do.

What does it do?

Jupiter's concept is extremely simple. It essentially computerizes the maintenance of a set of file cards. You use it much as you might use a set of standard 3" x 5" cards, with one for each of a number of individuals or companies. You could put different information in different areas of your 3" x 5" card: name and address on the top, say, and comments and transactions on the bottom.

Jupiter handles things in a very similar fashion. Under Jupiter, each of these "computerized file cards" is called a Data Record Card (DRC). A DRC is divided into three sections, called "frames."

The frames can contain the following information fields:

Frame #1:

Key (A title for each card—up to 16 characters)

Last date on which you accessed the card

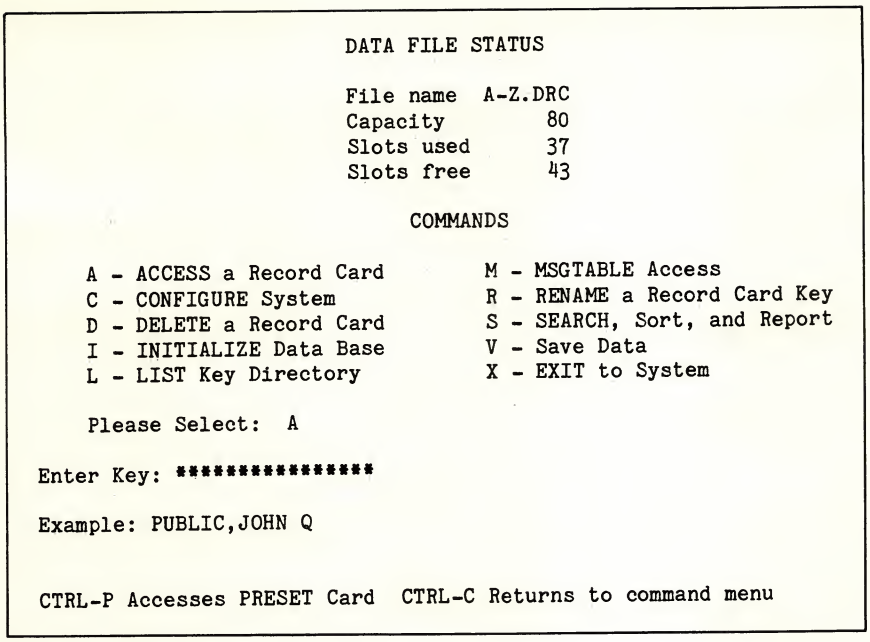

DATA FILE STATUS
File name A-Z.DRC
Capacity 80
Slots used 37
Slots free 43
COMMANDS
A - ACCESS a Record Card
C - CONFIGURE System
D - DELETE a Record Card
I - INITIALIZE Data Base
L - LIST Key Directory
M - MSGTABLE Access
R - RENAME a Record Card Key
S - SEARCH, Sort, and Report
V - Save Data
X - EXIT to System
Please Select: A
Enter Key: **********
Example: PUBLIC,JOHN Q
CTRL-P Accesses PRESET Card CTRL-C Returns to command menu

Figure 1. Jupiter's Main Menu during ACCESS.

A random-number code (more on this later)
Name
First line of the address
Second line of the address
City
State
ZIP code (up to nine digits)
Miscellaneous data or automatic salutation
Area code and telephone number

Frame #2:

This frame contains up to six "messages." These are items of general information chosen by the user. They will be taken from a group of strings you will create and store in the file MSGTABLE.TXT. (They might be things like "registered voter" or "contributor," if you were keeping lists for a local political group, for instance. And although you can have no more than six items in this frame for a given DRC, MSGTABLE will hold as many as 256 choices to select from.)

Frame #3:

Here we can have up to eight lines of "transaction" data. This could be the individual's last eight purchases, for instance, if you were keeping customer files for a small business. Each line can include the date, transaction item (what was purchased), and the amount.

The total of the individual transaction amounts is computed automatically and kept in this frame.

The basic idea is simple, right? And handling these cards, under Jupiter, is just as simple. The main menu shows the commands available at the start of a Jupiter session. (See Figure 1.)

How do you run it?

Looking at Figure 1, most of the command functions seem fairly obvious, but let's just look at them.

A — ACCESS
pulls in a file. After you type A, Jupiter prompts for the title—the Key—of the DRC you want to work with. It then awaits your entry of the first letter, or more, of the Key. If you can only remember the first letter of the Key, the program will show you all the Keys that begin with that letter.

C — CONFIGURE
is normally used only at initial setup and initialization. There you tell the program on which drives your various files will reside.

D — DELETE
does just what it says. It deletes an entire Data Record Card.

I — INITIALIZE
will initialize (i.e., create) a new, empty data base.

L — LIST
will list the Key Directory, one initial letter at a time.

M — MSGTABLE
allows you to edit the message table, MSGTABLE.TXT, the file where you store all the information messages that appear on Frame #2.

R — RENAME
lets you assign a new Key name to a Data Record Card.

S — SEARCH
will search, sort, and report. In this mode, you are able to specify the parameters you want to use to select specific categories of records. (For instance, you can search for and prepare a report on all records for which the city name does NOT CONTAIN "NEW".)

V — SAVE
will write your data to disk. This command should be used now and again during a working session, just in case of a power or computer failure. It is not required at the end of a session, since EXIT does a SAVE automatically.

X — EXIT
will take you to the operating system (CP/M).

With all these commands, only single keys need to be pressed; the carriage return is not required. All are useful and straightforward. After a couple of hours' use, most people will find it unnecessary to refer to the manual.

ACCESS—let's try it

The ACCESS command lets you call up or create a Data Record Card. After issuing an "A" command for ACCESS, you type in the Key, the name of the DRC you want to work on. Then Jupiter will present you with the first frame of the DRC that has that Key name. (Recall that the first frame contains the name, address and phone number, etc.)

The Key normally consists of last name, comma, first name, space, and middle initial. But for similar names, you can change this—as with "Jones1, John A", "Jones2, John A", etc. Jupiter allows up to 16 characters for the Key. But you don't have to use them all. (And if a name is more than 16 characters, that's no problem, either, as we'll see.)

Function keys f2 and f3, respectively, will call up the second and third frames. And f1 will return you to the first frame.

When a new frame is selected, the cursor moves automatically to the first non-filled field (or the Name field if all fields are full). The field where the cursor is located is shown in reverse video.

When you type in any data, the program initially accepts it as is. You can then move the cursor to another field. (LINE FEED takes you to the previous field; RETURN to the next field.)

As soon as you move to another field, the previous field entry is given proper capitalization by Jupiter, according to its own rules. In other words, you may enter a person's name in all upper- or all lowercase or any kind of mix of upper- and lowercase. Jupiter will capitalize the first letter of each of the first name, middle name or initial, and last name. All other letters in the name entry will become lowercase. (But hitting the caret (^) key before a letter makes it whatever you type in. So there's no problem with unusual capitalization.)

In the case of the telephone number, Jupiter will also check whether the area code is three digits with a "1" or "0" in the middle; and whether the correct number of digits has been entered.

When you are working in Frame 2, Jupiter will tell you if you attempt to enter a string ("contributor" or what not) which is not in the MSGTABLE.TXT file. It may just be a typographical error. If not, you then have the opportunity to go back to the main menu, select M, and add the new entry to the MSGTABLE.

After the new string is entered at the bottom of the MSGTABLE, the program will allow you to go back and enter that string onto Frame 2 of the DRC you were working with (or onto any other DRC).

Frame 3 accepts transaction data such as: the date; item; and amount of, for example, a recent dues payment by one of the group members listed in your data base. A running total is maintained for all the dollar amounts listed on Frame 3 of each DRC.

At any point while you are working in the ACCESS mode, HELP notes at the bottom of each screen display explain what to do at that point.

These HELP notes are particularly useful with the function keys. For example, the RED key abandons or sets the DRC aside without making any of the changes you may have keyed in; the WHITE key saves the card, with its changes, to a data file.

And that's all there is to using ACCESS to retrieve a Data Record Card, add to it, and then save it back to a disk file.

As noted, you try to ACCESS a record by entering its Key (or partial Key). If Jupiter doesn't contain the Key yet, you may proceed to create the record. Since Jupiter uses ACCESS both to call up and to create a DRC, you don't have to worry about giving the same Key to two different DRCs. Jupiter will just hand you the first one whether you wanted it or not!

After you type in the Key for a record you're creating, Jupiter will call up the first DRC frame, automatically unscramble the Key, and type the name on the first or "name" data field. When you're creating the DRC, the name entry may be incorrect because of similar names—or incomplete because of the 16-character Key limitation. Then you can—and should—go ahead and correct it, or finish entering the remaining characters of the name.

You can SEARCH, too

Besides ACCESS, the most often used command is the "S" or SEARCH command. It brings up the first of five "search-control" screen displays. Within these, you may key in virtually any search restrictions and criteria you might try to imagine.

Using the search-control parameters to fullest advantage takes some getting used to. A couple of hours of practice, though, and I was amazed at some of the things that can be done. With just a little doing—and no programming, per se—you can very quickly search a very large collection of records. You can pick out all your customers, for example, who are more than 60 days behind in their accounts.

Just how large a collection of records can be handled is one of Jupiter's really fine features.

How many DRCs can Jupiter handle?

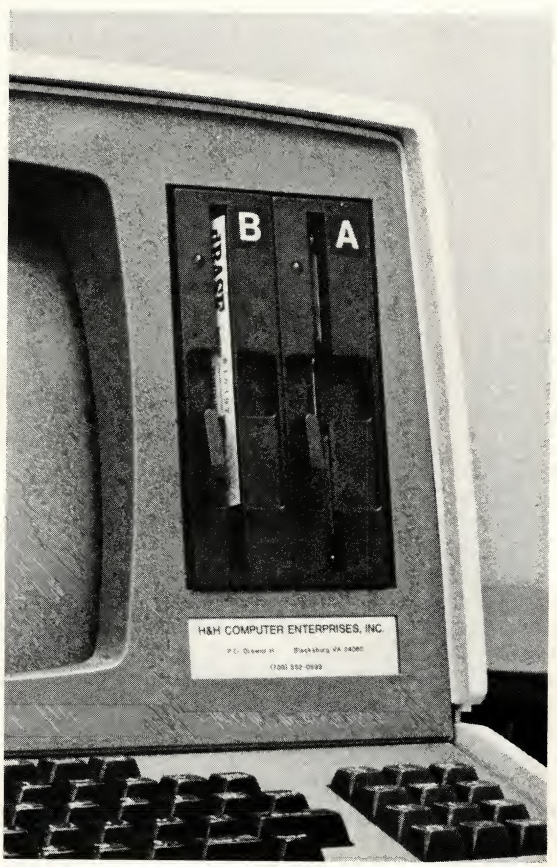
Through the use of data compression techniques, Jupiter is able to pack all the information about an individual or company into a single 128-byte CP/M disk storage "record" plus a short directory entry.

Not all the compression techniques are discussed in the Jupiter manual, but one that is alluded to is the Message Table. All notes that are referenced on Frame 2 of any of the DRCs, plus the State abbreviations from Frame 1, are grouped together in the Message Table. Thus, if any of this information is duplicated among the various DRCs, Jupiter only stores it once, in the Message Table.

According to the Jupiter manual, each DRC with its directory entry requires 142 bytes; so about seven DRCs will fit into one kilobyte of disk storage. A 90K diskette will hold more than 600 DRCs.

In a single data base, Jupiter can create and handle up to 13 files of either 1,300 or 2,500 DRCs each, depending on whether the host computer has 48K or 64K of memory. And Jupiter allows you to split up these files among several disks.

Using 64K memory and disks that can handle at least 2,500 DRCs each, the program can theoretically handle 13 times 2,500, or 32,500 Data Record Cards of information. In fact, says the



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File	Size
J.COM	2K
JUPITER0.OVL	29K
JUPITER1.OVL	16K
JUPITER2.OVL	15K
MSGTABLE.TXT	1K
DATE.TXT	1K
A-Z.DRC	Variable

Table 1. The files that make up the Jupiter package, and their sizes. Files A-Z.DRC would be your data files.

manual, the actual limit is around 25,000 cards since, statistically, at least one of the files will fill up earlier than the others.

This is because Jupiter assigns the boundaries of the various files. If, hypothetically, you had only two files, Jupiter would assign the letters A through K to the first, L through Z to the second. In breaking up your data base this way, Jupiter relies on the ordinary statistical likelihood that last names will begin with certain letters. As soon as one of the files is full, no more DRCs can be added to that file. So for all practical purposes, the entire data base is full.

This should prove no problem for most users dealing with randomly distributed last names. Some of you, however, may have a "statistically unlikely" data base. Computer-business lists, for instance, may have a disproportionate number of names beginning with "Micro." If so, you might want to consider a strategy to get around the limitation. (There's also a benefit to Jupiter's method of filing, however, as we'll see in connection with sorting.)

Disk handling

As with any data base management system, Jupiter benefits from large-capacity disks. At the extreme, an '89 with just one 5¼" hard-sectored drive is pretty well precluded from handling a significant number of names, no matter what DBMS you buy.

But with a two-drive system, using 13 90K-capacity hard-sectored diskettes, you can handle up to 13 times 600 or 7,800 DRCs. That's a perfectly respectable number for many small businesses, local organizations, etc. It will, however, require you to swap disks as you input data. Each time you try to ACCESS a DRC which is not on the current disk, Jupiter will prompt you for the swap. Simply inputting your data in more-or-less alphabetical order, however, should make that process relatively painless.

An 8" drive, of course, makes the job easier and increases the possible size of your data base. A single 8", double-sided, double-density disk will hold over 8,000 Data Record Cards. And, since Jupiter allows you to split up your data base among several disks, four of those 8" disks will handle Jupiter's 25,000 DRC limit with disk swapping.

Of course, a single Winchester hard disk will do the job, also, and very efficiently. Even with the lower-capacity dual H/Z37 soft-sectored 5¼" disk drives, more than 4,000 DRCs can be handled without disk-swapping. And the full 25,000 capacity is feasible with swapping of seven or eight disks.

Jupiter does, however, expect to see at least two drives (unless it's on a Winchester). On a 5¼" system, you will probably have Jupiter itself on one drive and your data disk(s) on the other. (See Table 1 for Jupiter's files.) On an 8" system, with a small data base, you can perform most normal operations with just one disk. Jupiter, however, will require a second drive when you restructure your data base to produce a new one. (See "Some other features," below.) Doing that, Jupiter needs the second drive as a "scratch disk."

Documentation

The manual has been well thought out and organized. Consisting of 124 pages contained in a heavy vinyl three-ring binder, it's divided into four major parts—and further subdivided into 19 sections. The appendix contains a list of Jupiter's error messages and a glossary of 52 terms from "Boot, to" to "Working disk." The glossary is a nice touch, often neglected.

At the very beginning of the manual is a single page of text that describes the "Organization of the Manual." More than a table of contents, it explains briefly the layout of the entire manual.

Part 1, the Introduction, gets the new user started. It includes a system overview, in some detail. "Getting Started" includes procedures for setting up a "Working Jupiter Disk." Finally, the author conducts a Jupiter walk-through which takes the user through each of the major operating features.

Part 2 covers more details for preparing a "working disk," configuring the program to your specific disk-drive arrangement, and setting up the Message Table. Finally, some usage hints and final setups are explained.

Part 3 covers data base maintenance in detail. It includes information on the built-in screen editor, on the transaction files, and on procedures for keeping the Data Record Cards up to date. Also described in this part are the recommended procedures for disk backup and for shutting down Jupiter at the end of a session.

Part 4 goes into searching, sorting, and report preparation. Five screen displays are introduced for use in these operations. Using these screen displays and their associated menus, the user learns how to search for specific classes of data cards using relational operators such as

"contains", "starts with", "from string... thru string...", =, > (is greater than), and so on.

Sorting, however, is something some of you may not need to worry about at all. If your main need is for alphabetical order, the job is already done. As you create DRCs, they are automatically stored in their files in last-name alphabetical order.

Part 4 also explains how to establish parameters for generating a report, i.e., establishing what data should be included in the report. An excellent mailing-label printout capability is also available. Its use is included and discussed here as a special "report" configuration.

Very specific report configuration parameters are explained, including: page length (in lines); top margin (in lines); one record per page (yes or no); pause for paper change (yes or no).

Parameters specific to mailing-label printouts are: number of labels across (one to four); vertical separation (in lines); horizontal separation from label to label (in character spaces); horizontal offset to first label (in character spaces).

Illustrations are provided, to make it easy to select the proper parameters.

One very nice feature of the manual is the author's inclusion of a one-paragraph summary at the beginning of each of the 19 sections. Each of the summaries is blocked off and bordered. It explains, briefly and clearly, the content of that section.

Illustrations and examples are used frequently. Explanations are fairly complete and easy to follow.

My first review copy of Jupiter was version 1.0. I was advised that version 1.1 should be ready in four weeks. As promised, the new disk arrived just four weeks later. The changed document pages took another two weeks. A complete replacement page was provided for each of the 33 revised pages. Since I didn't have to do any markups, the changed manual retained its original quality appearance and utility.

Another highlight of the Jupiter manual is its characteristic use of good grammar and spelling. Computerists seem, on the whole, to be notoriously poor spellers and grammarians; so it is especially gratifying to review and use a finished document that is free from the distractions of poor English.

Each page of the manual carries a heading consisting of the section number and title. Printing is done with a letter-quality printer in pica type. The text looks much better than that contained in the garden-variety computer documentation (from Digital Research, say). But typesetting would have provided that final professional touch so often lacking in "micro" documentation. (True, I'm prejudiced in favor of typesetting—so strongly that I got into the business myself!)

Finally, an excellent four-page index is included at the back of the manual. With the index, the table of contents, section summaries, and a logical layout, most users will have little trouble finding any topic or sub-topic they may wish to pursue.

Some other features

Jupiter makes use of most of the H/Z89's special features, including cursor control, reverse video, graphics, and special function keys. (As John Preusse puts it, "...bet you never knew the f1 and f2 key legends mean 'Frame 1' and 'Frame 2'....")

Jupiter automatically creates a "Random Code" for each Data Record Card. The code is a number between 0 and 15. Not strictly random, of course, it is derived from the Key. Its purpose is to permit data base searches to be done in a random manner.

For instance, let's assume you want to make a small "test mailing" to a random sample of your customer list. To do it, you could generate a random list of names of approximately one sixteenth of your total data base by selecting those DRCs with a given Random Code—"2", for instance.

One of the "reports" that can be produced by Jupiter is not a report but is, in fact, a new data base (mentioned above). You create one by first setting restrictions on a search, such as "ZIP

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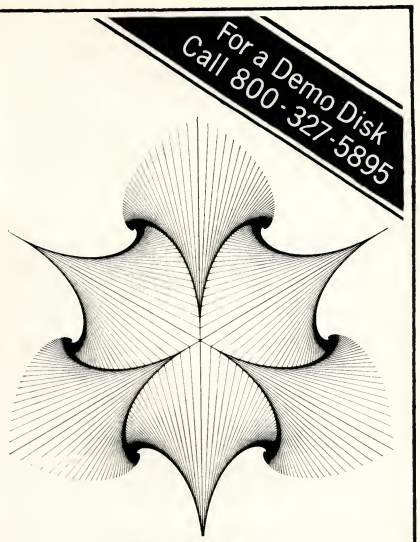

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CODES FROM 43000 TO 58000". Then you create a "report" by selecting option JDB—Jupiter Data Base. This then generates a new data base file with the restrictions you imposed in the search.

You can restructure your data base, create subsets, and merge various data bases together If you have one of the more powerful word processors, you can even include your Jupiter report output in form letters.

Every time you run Jupiter, you have the option of creating a "transactions" report. This report summarizes the things you have done to your data base in that session involving an AMOUNT in the transaction frame (the third of a three-frame Data Record Card). Generally, each new transaction will be appended to a transaction (.TRN) file. Jupiter automatically names each .TRN file by assigning it a number in sequence.

Jupiter's usefulness

A dBASE II, Jupiter isn't. But let's face it, many of us prefer to use only the "software horsepower" needed to get the job done. It is not necessary to buy WordStar if your needs can be handled by PIE or TxtPro. With some programs, in fact, the more expensive alternative often proves cumbersome. It's not unlike picking up a sledge hammer to do a tack hammer's job. That extra capability is dead weight when you don't need it.

I look at Jupiter in the same way. If the job that needs doing is to keep a bunch of names and addresses on the computer, Jupiter does it very nicely.

I haven't been able to find any shortage of "sorting" capabilities. It works quickly, with little fuss and no necessity to do any programming.

And, as mentioned earlier, Jupiter comes with a good built-in mailing-label utility. It can generate labels selectively on the basis of your specified search criteria such as ZIP code, city name, or other restrictions.

Since it is written in assembly language, Jupiter is very fast and efficient in memory usage. As mentioned earlier, the author's data compression techniques make for very compact data storage.

Some possible improvements

There are three things that I would like to be able to do with Jupiter that, currently, I can't.

For one, my company has a number of dBASE II files that I would like to convert over to the Jupiter system. I know that dBASE has the ability to output files in a form that can be read by a language like BASIC. For someone familiar with the compression technique used in Jupiter, I would think that it might be a fairly simple matter to write a program that would convert a set of dBASE II records to be compatible with Jupiter—at least for names, addresses, and telephone numbers.

Second, I would like to be able to add comments to the "comments" section of the Data Record Card without first adding those comments to the MSGTABLE.TXT file. Jupiter's author indicates that, were that the case, it is likely that users would tend to fill the message table very quickly—only 256 entries are presently allowed in the table.

That is probably true, but I would not mind trading a few bytes of data storage for that convenience. There are only 256 possibilities; so presumably each "message" or comment requires only a single-byte "pointer" within each Data Record Card. There should be only relatively little extra memory space taken up. It would be worth it to have the increased flexibility of being able to add comments directly to the DRCs. It's a nuisance to go back to the menu and then the "EDIT MSGTABLE" mode and then finally back to the record.

I can even imagine that someone might come up with a "garbage collection" program that would make it easy to go and edit the MSGTABLE. Such a program could let you look at all "new" comments or messages to determine whether they were redundant to existing comments with slightly different wording, such as "CUSTOMER IS A DEADBEAT" versus "THIS CUSTOMER IS A DEADBEAT."

And, finally, it would be very nice to be able to run Jupiter on the H/Z100. This is not possible with version 1.1, although John Preusse has said he intends to come out with a version for the '100.

In conclusion

Powerline Systems has been in the process of reducing Jupiter's price as the newer H/Z110 and '120 (and H/Z150) have come into competition with the '89. Starting at $145, it was reduced to $79.95, and now goes for $49.95. At the original price, many people might have had difficulty justifying the investment. But at the reduced price, just about anyone with the need (or perhaps only the desire) to keep a lot of (or even a few) records would do well to take a close look at Jupiter. It's fast, menu/function-key driven, user-friendly, and truly a "high-performance records-management" program.

Ordering Information

Jupiter, CP/M (specify disk format), $49.95.
COUPON, CP/M (specify disk format), $35.
Powerline Systems
P.O. Box 97
Lincroft, NJ 07738
(201) 747-2063

(Jupiter is also available at many Heath/Zenith Computers and Electronics Centers.)

HUGCON West Takes Off

A choice location and some reassuring words made the first Western Regional HUG Conference a pleasure to attend.

Mark Goodkin

Just a week after attending CHUGCON 84 in Arlington, Virginia, I flew to the West Coast to attend the first Western Regional HUG Conference. It was held on November 10 and 11 at the Disneyland Hotel in Anaheim, California. Several of us from *Sextant* attended.

In all, the event drew 630 people. This number encouraged organizers since it was the first conference HUGgies have held on the West Coast. (In 1982, CHUG's first conference drew a slightly lower number. But that didn't stop it from bringing in 2,000 people two years later. See the article on CHUGCON '84 elsewhere in this issue.)

The good showing at the first western HUG conference came about through hard work. Both Pomona Heath Users' Group and Anaheim HUG (ANAHUG) worked for over a year to prepare for the conference. Herb Freidman, president of Pomona HUG, put in long hours coordinating the effort.

Conference organizers did well in choosing the Disneyland Hotel as its location. Vendors had plenty of room for their exhibits. Carpeting in the exhibit hall relaxed the atmosphere. (At times, I felt like taking off my shoes.) The vendor area was located conveniently near the room where the seminars and panels were held. And the hotel staff was friendly and helpful. One vendor described the service as "person-to-person oriented."

Concern about Z100 support

The Z100 was a focus of debate at the conference. The question was whether the Heath Company and Zenith Data Systems (ZDS) had been giving enough attention to the '100. Charles Floto addressed this issue in his Saturday afternoon talk, "On Current HUG Concerns: Declining User Support from Heath/Zenith." As the title suggests, he felt that ZDS has been giving inadequate attention to the '100.

Charlie pointed out this concern (as well as others) in his editorial in *Sextant* #13, November-December 1984. (The editorial said that he hoped to "spark discussion of user support independent of Heath/Zenith at the Western Regional HUG Conference.")

In his talk, Charlie said that ZDS's inadequate emphasis on the '100 could be seen in the company's failure to keep up with demand for the '100. He said, "For about the last year now, the Z100 series has been backordered. The management simply didn't order enough parts to be able to build enough for the number they subsequently sold."

The reason Zenith didn't build enough '100s, Charlie explained, is that they "did not really appreciate the strength of the Z100 in the marketplace." They built the '150 to compete with the IBM Personal Computer. And in so doing, they diverted much of their resources from the '100. They simply didn't have enough confidence in the '100.

Both Pomona Heath Users' Group and Anaheim HUG (ANAHUG) worked for over a year to prepare for the conference.

But, Charlie added, people kept on buying the '100—"despite the fact that IBM was out there making computers." Clarkson University gave a Z110 to every entering freshman. And the Air Force, Navy, and Marines chose it as their standard personal computer.

He explained that the strong demand for the '100 comes partly from certain advantages the '100 has over the IBM PC. "Some of the people," he said, "were attracted by the fact that you could actually read the letters on the screen; that you could actually find the return key on the keyboard."

HUGgies also heard the other side of the story.

In his Saturday morning talk, William Johnson, president of the Heath Company, emphasized that the '100 plays an important role in Zenith's policy. At present, he said, many companies are building personal computers. But "this business cannot continue to support 100 or 150 different manufacturers. ... In the large business we're in, it's very safe to be compatible with Big Blue." So, Heath and Zenith have developed "a couple of niche markets"—the '100 and '150. That assures them of "being one of those finalists."

But Johnson didn't explain how the '100 could fill its niche market when it's always backordered. On Saturday afternoon, the backorders were explained by Tom Dornback, vice president of ZDS for software engineering. Zenith hadn't underrated the demand for the '100. Rather, he said, the Air Force had underestimated the number of '100s it would buy under the Z100 contract. (Orders from the Air Force and other contract customers have to be given high priority.)

Software for the '100

Besides concern about ZDS's support of the '100, some questions were raised about *software* support for the '100. Someone from the audience asked Charlie why anybody would want to have a '100 when it takes so long to get software for it. For example, he said that some software hadn't come out for the '100 until a year after it came out for the IBM Personal Computer.

Charlie replied that a number of software developers in various companies would like to support the '100 "if there was some *incentive* for them to do so." It really gets down to how much incentive Zenith is willing to offer, he said.

But some others from the audience thought that the slow entry of new software for the '100 didn't matter. They were satisfied with the software available for the '100. One man stood up and said, "We've got Peachtree. We've got all the word processing I need. I've got all the business programs I need. And as a matter of fact, there are more programs than I can afford out there...."

The value of communicating

The question of ZDS support for the '100 may not have been resolved. But what's more important is that, at the conference, HUGgies and Heath/

Zenith officials discussed the concerns of HUGgies on user support from Heath/Zenith—in a friendly atmosphere. The idea that it's important for both sides to communicate was an important theme at the conference.

In fact, it may have been the first time that this idea was presented so formally at a conference. It wasn't the first event where HUGgies raised their concerns to Heath/Zenith officials. But it was the first conference to devote blocks of time specifically to address these concerns. The conference devoted most of Saturday afternoon to this—in Charlie's talk and the panel discussion that followed.

Both HUGgies and Heath/Zenith officials generally felt good about the exchange. At the banquet, Bill Johnson said, "I think it's tremendous that we could meet together, drink together, eat together, talk together, *argue together*, and move this company and our products forward together."

Ray Dick, western regional manager of Heath Company, told me how pleased he was with the well attended panel discussion. He liked "the honest sharing of ideas." Admittedly, after being with the Heath Company for 16 years, he "bristled" upon reading Charlie's editorial. But Dick added, "Then after listening very carefully to what Charlie had to say, and the comments that came out, Charlie had a lot to say. He brought up some very good points."

Charlie said that it went so well that he'd like to see "similar communications and opportunities in other parts of the country at other times of the year."

National HUG's library

Have you thought about writing a program for the national HUG software library? In his Saturday morning talk, Jim Buszkiewicz explained how HUGgies can submit their programs to the library.

You can submit your program into any one of three software sections of the library, he said. These sections are public domain, standard, and royalty software. The main difference between submitting to the standard and royalty software sections is how HUG compensates you for a program.

If HUG accepts a program you wrote for the standard software part of the library, Buszkiewicz said, you will get a one-year extension on your membership in HUG. (Or if you're not a member, you'll become one automatically.) You will get a copy of HUG's released version of your program. "And you get your choice of any Heath or Zenith software product," he said.

If your program is accepted in the library's royalty section, you will usually get 20 percent of the program's selling price. A $20 program will bring you four dollars for every copy sold.

Buszkiewicz recommended submitting to the standard software section. It's "probably a little bit better than the royalty library." He explained that when you've submitted to the royalty section, you must wait until the end of each quarter before being paid.

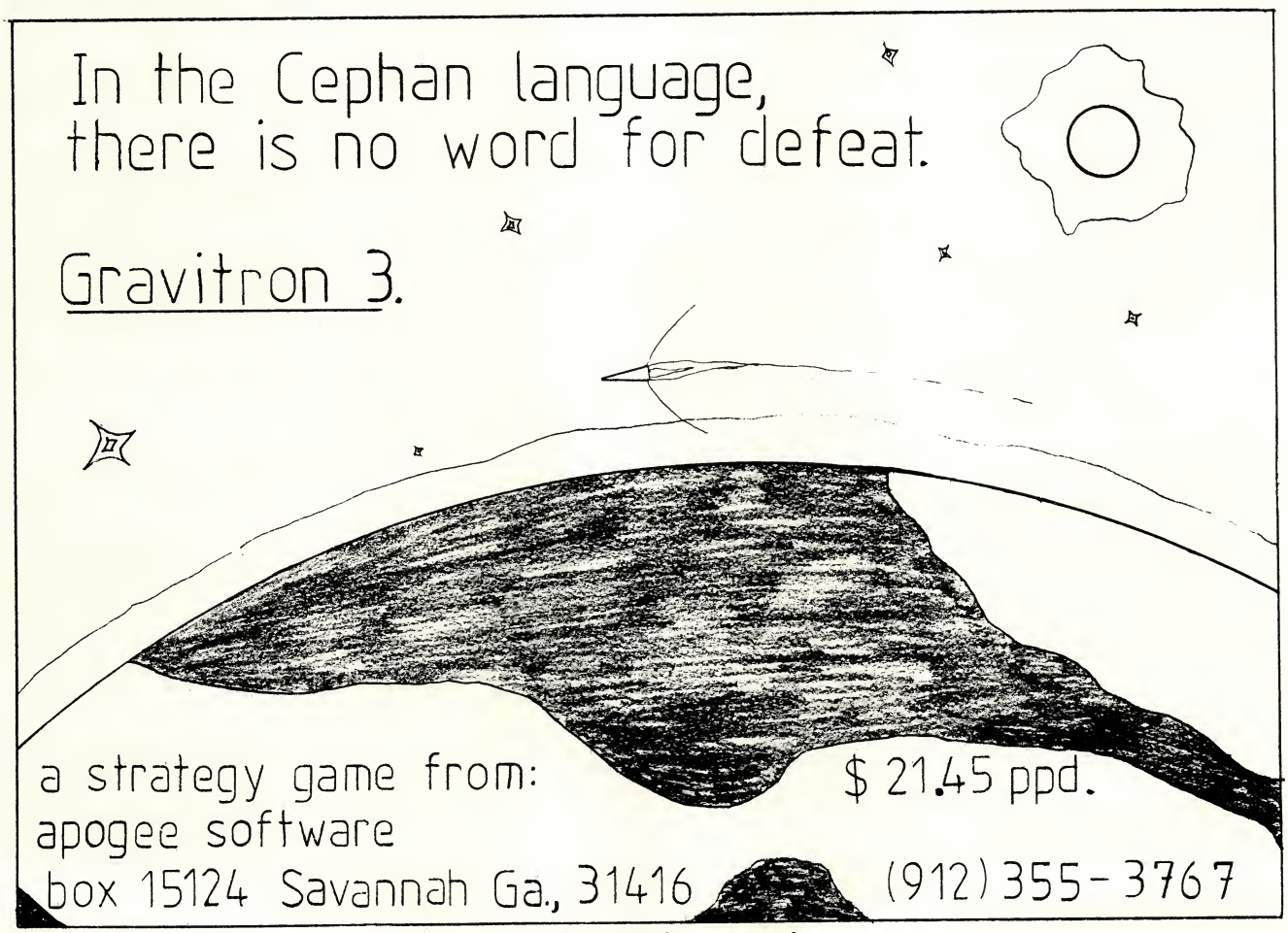
If your program is accepted in the public domain section, HUG will give you a copy of the disk on which your program appears. You'll probably have no problem getting it accepted, he said. A program submitted to the public domain section is simply not checked that much for errors. "We see if it runs to some degree. And if it does, it's placed in the library."

But it's more difficult to get a program accepted into either of the other two sections, he said. He'll carefully check it for such things as adequate documentation and popular demand by HUGgies. He'll also see whether it has any program errors. And he added, "I try my darndest to break it."

What the future holds for Heath/Zenith

On Saturday afternoon, someone asked Tom Dornback why Zenith never announces its plans on future products. One reason, Dornback said, is to not inform their competitors.

Another reason has to do with the way Zenith develops its products. "There are many products," he explained, "that we evaluate and discuss, and design, re-



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- Coverage of community affairs. You'll read about **major events and personalities** in the Heath/Zenith user community, and what effect they could have on you.

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design, rebuild, redesign, rebuild, at the company before you see them. And if we announce something early in its development by publicly disclosing it, I can tell you it wouldn't be the same product when it reaches the street."

Despite Zenith's policy of keeping its plans on future products to itself, Dornback shared some "personal predictions." In the next couple of years, he said, software will be more complex. "There seems to be a trend to build everything into one." He added, "the manual will be heavier than the machine in many cases."

Starting The Software Toolworks

I always enjoy hearing how people began their profession or career. On Saturday afternoon, Walt Bilofsky, president of The Software Toolworks, spoke on how he got started in software publishing.

In 1979, Bilofsky bought his first H89 kit. After putting the kit together, he said to himself, "What can I do with it?" At that time, he said, the only operating system for the '89 was the Heath Disk Operating System (HDOS).

Since only a small amount of software was around to run on it, he wrote some of his own. To name a few, he put together a modem package, a screen editor, and a C compiler. Reflecting on these programs, he thought, "Gee, maybe some other people would like these programs. I wouldn't mind selling them for 20 or 30 bucks."

So, he sent a product announcement to *Buss: The Independent Newsletter of Heath Co. Computers*, and went away on a consulting trip. When he returned, he found his mailbox full of checks. "It was then I realized that I was in the software publishing business."

Then in June 1980, he and his friend Jim Gillogly decided to advertise their software in *Byte* magazine. They had to have a name to advertise it under, he explained. "So we decided to call it The Software Toolworks."

HERO Jr.—useful as well as cute

Speaking on Sunday morning was Wayne Wilson, Heathkit's product line manager for general consumer, amateur radio, and weather products. Wilson wanted to clear up one thing: that HERO Jr. isn't just something to entertain the kiddies. It's useful too.

If you wish, you can use HERO Jr. as an alarm clock. Wilson set HERO's alarm for 10:30 a.m. A minute later, HERO said, "Good morning, good morning, good morning. It's 10:30 a.m. Please wake up! Please wake up! (pause) Are you awake?! (pause) Well, I'll let you sleep for ten more minutes. I hope you're not going to be late." He gives you just two more chances to wake up. After that, he shuts off.

Moreover, you can use HERO Jr. to remind you of things like birthdays and business meetings. You can set him to give you the reminder any time—specifying a minute, a day, a year—or even 99 years from now.

On top of that, with his light and motion detectors, he can help guard your home or office. Wilson demonstrated HERO Jr.'s ability to spot motion. HERO first said, "I'm looking for people." Then he began turning. Once he spotted Wilson, he asked in his robot tone, "Are you a human being?" to which Wilson responded yes. Wilson said, "When he's looking at the cat, that's kind of cute."

How good is educational software?

On Sunday afternoon, I attended a panel on computers in education. Most of the panel members were computer teachers and educational computer consultants. A major concern brought out in the discussion was the poor quality of most educational software.

A big reason for this poor quality, one panelist said, is the lack of economic incentive for software companies to come out with higher quality educational software. He said that when those who buy educational software want more copies of the same program, ideally, they should buy them. But usually it doesn't work out that way. Most of the time, they just copy the program.

That explains why software companies have concentrated on more lucrative markets—such as business and government—in which this sort of copying by customers doesn't take place as much.

As far as a solution to improving the quality of educational software, none of the panelists could agree. One of the proposed solutions was directed to HUGgies—that they work with educators to develop better educational software.

Exhibitors

The conference program listed 21 exhibitors. More vendors could have attended had CHUGCON 84 not been held just one week before. Some of the vendors who attended CHUGCON found it inconvenient to attend another HUG conference a week later. (And the Air Force Small Computer Conference was only two weeks before CHUGCON.)

Among the vendors attending the Western Regional HUG Conference was Heath/Zenith Computers and Electronics. They discounted the price on many of their products—the H/Z89, H/Z100, and H/Z150 computers, and a wide selection of printers, software, memory boards, and disk drives.

On display at SigmaSoft and Systems were its graphics board and software for the '89. Clay Montgomery, owner of SigmaSoft, felt optimistic about the future of both the '8 and '89. "A lot of

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APPOINTMENT CALENDAR
Version 2.1 for MSDOS/ZDOS
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APPOINTMENT CALENDAR is a ZBASIC program designed especially for the H/Z-100 computer. APPOINTMENT CALENDAR will let you create, store, edit, display, and print a calendar of important events and times for appointments, schedules, and special occasions. It directly supports the Epson MX, RX, and FX series of printers, the Heath H-14 and H-25, Diablo 630, and MPI 99/150 printers. Virtually any other dot matrix or letter quality printer is supported by a standard ASCII version of the calendar printout.

APPOINTMENT CALENDAR is very easy to setup and use. It is fully menu driven and the program automatically provides default input entries and verifies user inputs to insure correct entry of data. The program is tailored to the Z-100 and takes advantage of the display and keyboard features built-in the Z-100. The function keys are used for command selection, and a command label appears above the function keys in the 25th line to make operation simple and straight-forward.

If you have important dates, birthdays, anniversaries, special events and you want to keep track of them on your computer, then APPOINTMENT CALENDAR is for you.

For Z-100, 128k memory minimum, Z-BASIC **$29.95**

Z-TOUR 1000
Copyright 1984 by John E. Miles
Produced by Newline Software

Z-TOUR 1000 is an auto race 'card game' that simulates 'real life' driving situations. **Z-TOUR 1000** is a computer adaptation of the familiar Mille Borne card game. A full screen color display showing all cards and the playing board in vivid colors, quick speed, and complete implementation of all game rules, including COUP FOURRE and optional game extension make **Z-TOUR 1000** an interesting and fun game for adults and children.

The object of the game is to accumulate 10,000 points during several hands of play. During each hand, you and the computer will each try to travel exactly 700 miles, or exactly 1000 miles in the case of an extension. By drawing cards from the deck, you and the computer will be trying to slow each other down by placing road hazards in the way while you advance to the finish line.

In order to proceed, you must have a green light. If you see a stop sign, you must stop. You must obey the speed limit signs. If you have an accident, you must have your car repaired. If you run out of gas, you must fill your tank. If you have a flat tire, you must install a spare tire. The card deck contains cards for all the hazards, remedies, and mileage. How well you do is based on the luck of the draw and the skill with which you play your hand against the computer.

Z-TOUR 1000 is a challenging, cerebral computer game. If you're tired of the fast-paced video arcade style games that tax your manual dexterity rather than your game playing skills, you'll enjoy **Z-TOUR 1000.**

Requires: H/Z100 computer with color video ram installed, a color monitor, ZDOS or MSDOS, and ZBASIC.

For Color Z-100: **$29.95**

BOXES & SWITCHES
Two Games for the Price of One.

BOXES
Copyright 1985 by Terry Wilk
Produced by Newline Software

BOXES is a pixel graphics game program for the Z-100 with or without the color option. Perhaps you know the game by other names such as "Dots" or "Dot-to-Dot". It is a game of both skill and chance. You can play against another person or the computer. Briefly, the game is composed of a grid of dots. Each player completes a turn by drawing a line between two adjacent dots, with the intent of completing a box or making a move that does not allow your opponent to complete a box on his turn. Whenever you complete a box, it is marked as your's and you get another turn. The object of the game is to create more boxes than your opponent. **BOXES** is designed to be easy to learn and operate for game players of any age.

SWITCHES
Copyright 1985 by Terry Wilk
Produced by Newline Software

SWITCHES is an original pixel graphics puzzle program. The puzzle is composed of different rectangular parts. **SWITCHES** starts off with all parts set to one color called the "original color". The object of **SWITCHES** is to switch all of the puzzle parts from the original color to another color called the "switch color". You do that by selecting one rectangular part to switch to the opposite color. You can switch any part's color any number of times and in any sequence you like. However, the catch and the challenge is that in switching a part's color all adjoining parts will also switch color. The problem is in figuring the sequence of switches to solve the puzzle. You can try to solve the puzzle yourself, or watch the computer try to solve it. The number of puzzles is virtually limitless! This one will really get you thinking.

Program Requirements:

H/Z100 Computer with Z-DOS or MS-DOS 2.0, 128K of memory minimum, one or more disk drives, Color (optional). A Printer is optional for the SWITCH program. Both BOXES and SWITCHES are included.

BOXES & SWITCHES **$29.95**

$TECH
Technical Analysis Program
Copyright 1985 by Newline Software

Ever put your money in the right place at the wrong time? Really frustrating isn't it? How do the "Big" guys do it? Part of their secret is knowing what to buy. The rest is knowing when. What you need is some help in making that critical timing decision.

$TECH is an easy menu-driven program that opens up a broad array of technical analyses to look at several types of investments. Predicting future prices, making commodity decisions, looking at the impact of inflation, making a graph of price moves, are all part of this program. Each routine lets you enter your own data and it does the rest. You have the following choices available to you:

- Cash Flow Analysis
- Regression Analysis
- Exponential Smoothing
- Moving Averages
- Commodities Analysis
- Investment Return After Inflation
- Scattergram Program

Have you ever asked yourself, "Is this really worth it?" Now you have a variety of tools to help answer that question. No more tedious number-crunching. Sit back and do what you always wished you could do—focus on what this all means. In addition, the program comes with complete documentation to explain each routine and how it can be used. So your IRA earns 10% each year? What will it be worth in 20 years after inflation? $TECH will answer that and much more.

What's so unusual about this software? First, it was designed with the user in mind. This little guy is not only friendly, he's also accurate and FAST. Why wait? You don't have to be a computer wiz, just do the following:

- Get a copy of $TECH
- "Boot" up your system
- Start making more money . . .

So why wait? At this price you can afford to make a fast decision!

For Z-100: 128K minimum, MS-DOS, Z-BASIC **$99.00**
For Z-150, IBM-PC: 128K minimum, MS-DOS or PC-DOS **$99.00**
For DEC Rainbow: MS-DOS or CP/M-86/80, MBASIC **$99.00**
For DEC DECmate II or DECmate III: CP/M, MBASIC **$99.00**

$FUND
Fundamental Stock Analysis Program
Copyright 1985 by Newline Software

Are all your stocks "In-The-Money"? Want to know the "Big" guys' secrets? If you aren't satisfied with your selections, you need to look at how other traders make theirs. Some would tell you that "It's all in the timing." That's only half-true. Knowing what to buy is the other half. This program is designed to help you make more money by choosing the right stock.

This easy menu-driven software not only performs a variety of fundamental analyses, it also has complete documentation to explain what all this stuff means! Here is a way to avoid tedious number-crunching and, instead, focus your gray-matter on the bigger issue—Which one is best? Use any source of "balance sheet" data and this program will really do a job for you.

You got a "hot tip" and want to check it out? You provide the program with some raw information and it calculates the following:

Liquidity	Leverage
Current Ratio	Debt Ratio
Liquidity Ratio	Times Interest Earned
Quick ('Acid') Ratio	Long-Term Debt to Assets

Activity

Inventory Turnover	Return on Fixed Assets
Fixed Assets Turnover	Return on Capital
Total Assets Turnover	Equity Ratio
Return on Sales	Net Income to Net Worth
Return on Total Assets	Predicted Share Price
Return on Net Worth	

Wait!! There's much more . . . This program allows you to also compare up to THREE stocks simultaneously. This could mean looking at three possible choices in one stock family or looking at a single stock over three periods of time.

Now you have a way to make all these numbers come into focus to help you make a better decision. Why have you waited so long? Probably because you didn't want to spend hundreds of dollars on software, only to find yourself tied to someone's electronic database. Sometimes that's okay—sometimes not. Here's a way to have a choice in the matter.

For Z-100: 128K minimum, MS-DOS, Z-BASIC **$ 99.00**
For Z-150, IBM-PC: 128K minimum, MS-DOS or PC-DOS **$ 99.00**
For DEC Rainbow: MS-DOS or CP/M-86/80, MBASIC **$ 99.00**
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VEHICLE FLEET MANAGEMENT
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people are looking at the support they've got for the '100 and saying, 'I'd just as soon stick with my '89. I'm comfortable with it. And I've got a large software investment in it.'"

Some of the local HUGs had set up a disk-copying center to copy public domain software for a nominal fee. Every time I looked their way, they were busy.

Dinner and door prizes

Evidently, the HUG dinner wasn't the only banquet going on at the hotel on Saturday evening. I found this out the hard way by accidentally walking into a banquet held by a health conference.

When I entered the right banquet, I saw the place crowded with HUGgies. Among those seated at the head table were officials of Heath and Zenith. One of them was Joe Schulte, president of Veritechnology Electronics Corporation, which runs the Heathkit stores. Addressing the crowd, he commented on how pleased he was with the conference, and said that he would support another Western Regional HUG Conference.

Bill Johnson then went to the podium. He commended Herb Friedman for an outstanding job and placed a Mickey Mouse cap on Herb's head. After everyone stopped laughing, a red-faced Friedman said, "I don't know how much longer I can wear this—but I appreciate the thought."

Earlier that day, Friedman, sympathizing with those who wouldn't win door prizes, said that after the banquet, some of the attendees "will walk away with a good taste in their mouth, and the rest will leave with just heartburn."

Friedman wasn't quite right. Although I didn't win a prize, I walked away with a good taste in my mouth. The waitress accidently brought us desserts from the other banquet. When she realized what she had done, she apologized and brought over the right dessert. For me, getting an extra dessert made up for going away empty handed.

Bob Ellerton announced the prize winners. When Ellerton first took the podium, he asked Bill Johnson's wife, Pat, to draw the name of the grand prize winner. Ellerton took the name and said, "Okay, the winner is—we'll find out later. Isn't that *mean*?"

Following the custom of past HUG conferences, Ellerton placed the winning ticket next to the grand prize. He would reveal the winner once he had announced the other prize winners. (These other prizes were donated by vendors attending the conference.)

Later, as promised, the grand prize winner was announced—Michael Osborne. Osborne had his choice of either a Z120 or Z151, donated by Veritechnology. With hardly a second thought, he pointed to the '120 with Winchester drive.

Then Johnson stood up and said, "Well, losers, we can't all be winners. But there ought to be at least one other winner." He surprised everyone by announcing that he would draw a name for a $500 gift certificate good for anything in the Heathkit catalogue. The winner ran up to claim his prize. Then he said, "Let's do it again." A $500 gift certificate went to another happy winner. Then someone from the audience shouted, "How about drawing one for an increased line of credit?"

Another HUGCON West?

On Sunday afternoon, Friedman told me that he had received a lot of feedback on the conference. Most of it was good. Many people told him they wanted to see another conference in 1985.

If another conference is held, it will present Friedman and the other local HUGgies a new challenge. We've seen how the attendance at CHUGCON has grown. We might expect another Western Regional HUG Conference to follow a similar trend. If conference organizers decide to put on another conference, their new challenge will be this: to prepare for a greater crowd, while maintaining the high standard seen at the 1984 Western Regional HUG Conference.

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Circle #173 on Reader Service Card

Add an Automatic Brightness Control to Your '89

Your '89 or '19 can adjust itself instantly to any level of ambient light.

Ray Albrektson

It was late afternoon; the usually dim and comfortable corner where I keep my H89 was bathed in the yellowish glow of another tropical sunset. The only problem was—I could barely see the screen!

I went through the afternoon ritual to adjust the brightness. First remove my watch and ring, then open the H89. I carefully snake my hand past the neck of the cathode-ray tube, musing on what a CRT implosion is *really* like. Dodging the high voltage lurking on the left side, my trained fingers find their goal—the video brightness control. "There's *got* to be an easier way," I grumble as I reverse the procedure in order to extricate my hand.

The easier way

Later one evening I observed that, of course, there *was* an easier way; and the designers of my television had discovered it. A small photocell sensed the light level falling on the TV and turned the brightness up and down (within limits, of course) to compensate. Why couldn't I do that with my H89?

Two hours later and $1.88 poorer, I had the prototype installed and working. As on my TV, a tiny photocell now peeped out of the lower left side of the plastic bezel surrounding my '89's screen. (Yes, "bezel." That *is* the name of the front piece through which the screen and disk drive appear.)

When there was a lot of light in the room, the photocell cranked up the screen's brightness so that the characters were just as easy to read as they were in the morning dimness. When evening came, the H89 dimmed itself to a comfortable and soothing intensity.

What if you have one of the newer H/Z89s with the brightness control on the back panel? This is certainly more convenient to adjust than the earlier models. But that easy access can be a danger as well.

I once noticed an '89 in a Heathkit store that seemed to have a game maze permanently burned into the screen. It seems that some inquisitive youngsters had discovered the brightness control, played a few rounds, and left with the brightness on maximum. Result? A permanent reminder of their visit.

With a self-adjusting brightness control, the chance of burning the screen would be reduced to practically zero. The self-adjusting control cannot turn the brightness level higher than the maximum to which you'll set it.

The self-adjusting brightness controller tracks unnoticeably through the day.

How it works

Before embarking on the details of how to install the brightness control, it would be good to understand something of the theory of operation.

The video board receives the video signal from the terminal board in three parts. Two of these are the synchronization signals to control the horizontal and vertical sweep of the electron beam.

The third is the video signal itself. The positive-going pulses on this line (see Figure 1) represent the dots which, when displayed on the CRT, make up the characters and graphics.

The height of each pulse represents brightness. The brightness control on the video board (or on the back panel of newer '89s) is just a potentiometer; its variable resistance scales that brightness to whatever the user prefers.

The goal of our modification is to insert a light-sensitive device into that signal path so that the brightness level will go up when the ambient light level increases, and vice versa.

The circuit I came up with consists of a potentiometer coupled with a phototransistor of the most common variety. The two together make a combination

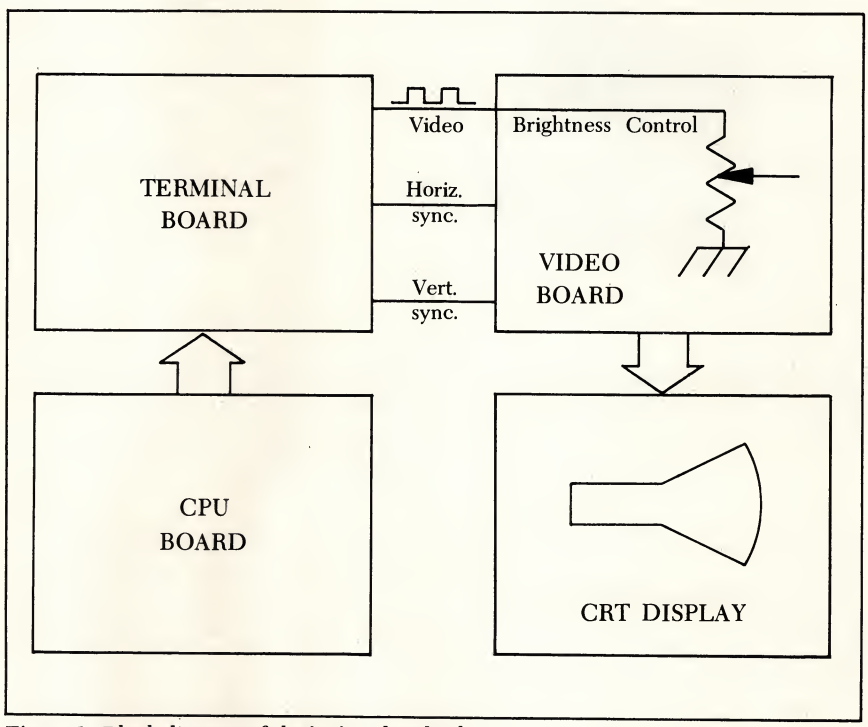


Figure 1. Block diagram of the '89's video display.

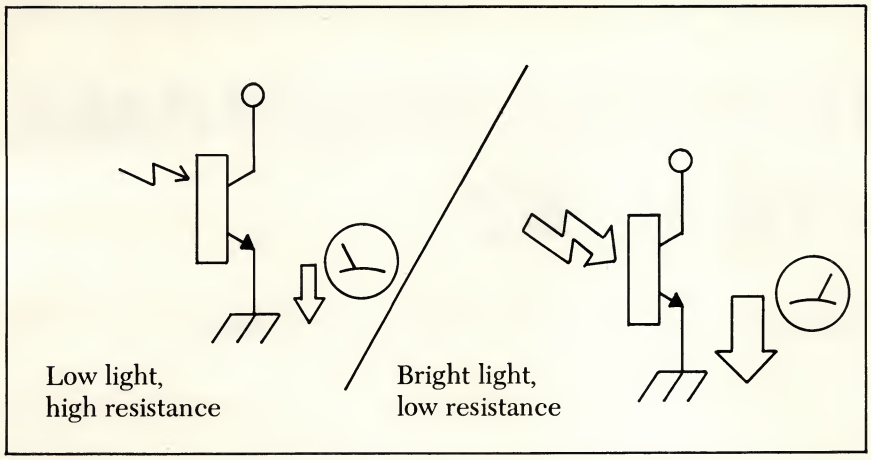


Figure 2. Operation of a photo-transistor. When a light shines on it, resistance decreases, resulting in an increased flow of current.

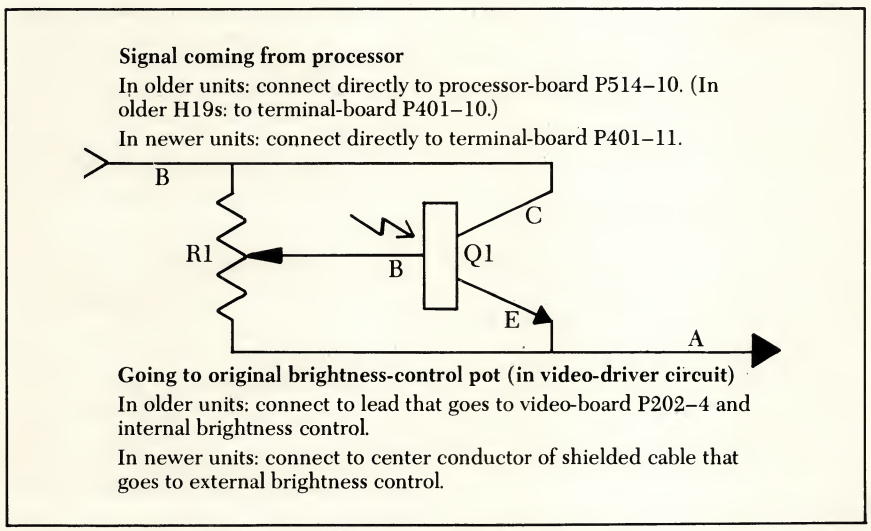

Signal coming from processor
In older units: connect directly to processor-board P514–10. (In older H19s: to terminal-board P401–10.)
In newer units: connect directly to terminal-board P401–11.
B
R1
B
C
Q1
E
A
Going to original brightness-control pot (in video-driver circuit)
In older units: connect to lead that goes to video-board P202–4 and internal brightness control.
In newer units: connect to center conductor of shielded cable that goes to external brightness control.

Figure 3. Schematic diagram of the automatic brightness control.

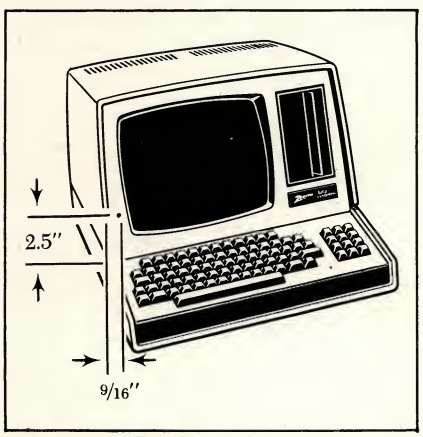


Figure 4. H/Z89, showing author's location of hole to be drilled for photo-transistor in the '89's bezel.

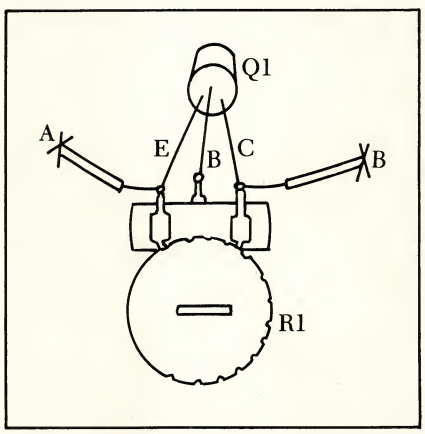


Figure 5. Potentiometer R1 is soldered to photo-transistor Q1 as shown. Lines E, B, and C of the photo-transistor are the emitter, base, and collector, respectively.

that performs just as we wish. (See Figure 2.)

The top of the transistor package is clear plastic. Light shines through it onto the sensitive region of the device. When the emitter and collector of the transistor are hooked up to a voltage source, current can be made to flow just by shining a light on the transistor.

The problem with an ordinary photo-transistor is that it would take an enormous amount of light to control our video signal. We need to make the photo-transistor more sensitive.

The circuit in Figure 3 shows a simple way to make the photo-transistor as sensitive as we need it. Photo-transistors can be turned on by light alone; but they can also be made to conduct by passing a current through their base-emitter junction, just the way regular transistors are turned on. We will use a combination of both.

The potentiometer (R1) is adjusted to turn on the transistor enough so that a low level of screen-brightness is maintained in dim conditions. When added light hits the photo-transistor (Q1), it conducts enough to brighten the screen to an easy viewing level in bright light.

Hooking it up

Making and installing the self-adjusting brightness control requires only a low-wattage soldering iron, a drill (preferably a variable-speed electric drill), and the parts mentioned in Figure 3.

First drill a hole through the bezel of your '89. The hole should be the exact size of the photo-transistor diameter. Use an awl or some similar pointed tool to start the hole and complete it on a slow speed with the drill. (If you have only a high-speed drill, you may want to start with a fine drill; then move up to the correct size.) Avoid heat build-up that can cause the plastic to melt and deform the hole.

After opening the cover and looking inside, I think you'll see that you have to drill the bezel "as it sits." Some of you, though, may be concerned about dust getting near your disk drives; and you might start to think about removing the bezel and drilling it while it sits on your workbench. Unfortunately, taking off the bezel is a major operation—and would leave the CRT completely unsupported. It will be a lot better to work with the '89 as it is, rather than trying to take it apart.

A dash of paranoia won't hurt, though, if you drill the hole where I did. As noted above, I chose a location near the lower left corner of the screen. (See Figure 4.) There, you'll be aiming the drill in the general direction of the CRT. There's ample room, and not much danger your drill could come in contact with the CRT. But there's no point in being sloppy. I prefer *not* to find out what an implosion is really like!

As an alternative to my location, you might consider placing the photo-transistor on the right side. If you don't have an internal drive, you'll have plenty of space. If you have one, you'll have to remove it so you can drill. (And so the drive is kept away from any dust.) Taking it out and putting it back is relatively straightforward, though.

Irrespective of dust, CRTs, etc., some people have a horror of drilling holes in their computers. If you just can't bring yourself to drill in that lovely structural foam, it may be possible to rig a kind of external bracket for holding the photo-cell; but it would probably look worse

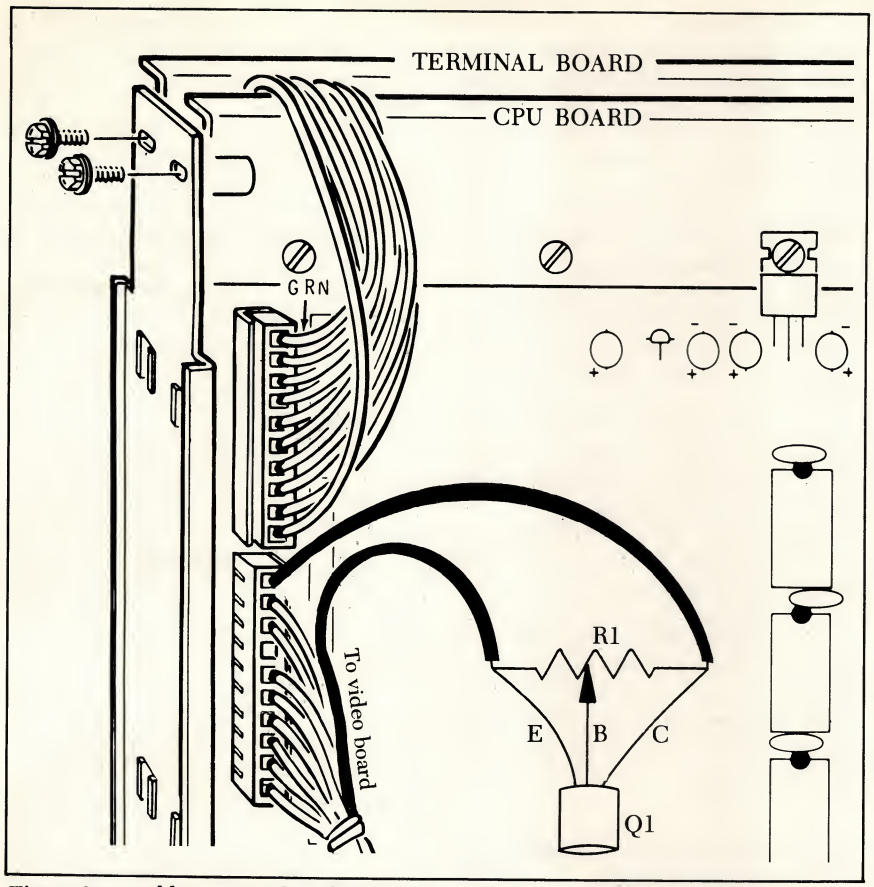


Figure 6a. In older units, splice the Q1-R1 assembly into the yellow video wire as it goes into hole 10 of P514 on the CPU logic circuit board. Be sure that Q1's emitter goes to the video board.

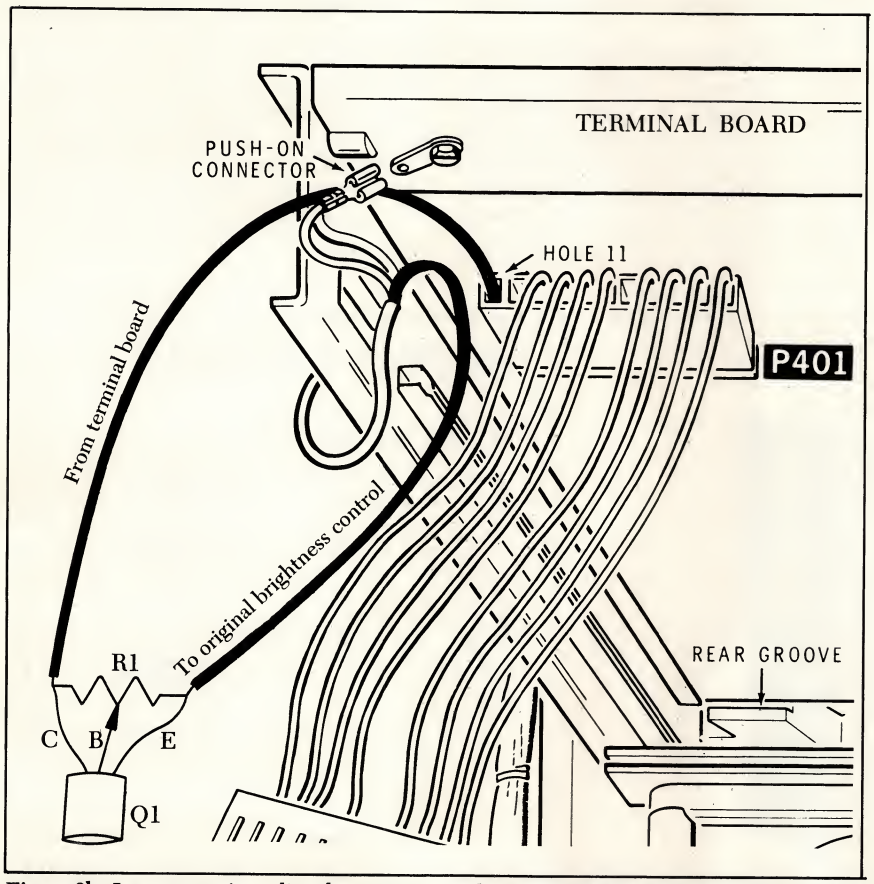


Figure 6b. In newer units, splice the Q1-R1 assembly into the black two-conductor shielded cable that runs around the side or over the top of the terminal logic circuit board.

than a nice neat hole.

Trim the leads of the photo-transistor to a length of about half an inch. Then solder them to the potentiometer as shown in Figure 5.

Attach hook-up wires to each of the two outer legs of the potentiometer (R1). Use suitable lengths to go from the bezel to the place where the automatic control will be spliced into the brightness-control circuit. (See Figures 6a and 6b.)

The photo-transistor circuit is simply spliced in series with the '89's own brightness-control potentiometer. I've put it between the CPU and the original pot. (As is indicated in Figure 3, the collector is on the CPU side; the emitter goes to the original pot.)

Unfortunately, not all '89s *look* alike in this regard. At one time or another, Heath/Zenith has incorporated three different designs for the brightness control.

My '89 (with the control inside the case) seems to be the most primitive. Later, they moved the control to the back panel. The final version of which I'm aware also has a redesigned video board; but the relevant circuitry seems unchanged except for new component numbering.

Fortunately, then, all three versions appear to be electrically identical. The only problem will be finding a convenient location to splice the auto-brightness control into your circuit.

If you have the oldest version, as I do, you can use Figure 6a as a guide. There, you'll see a rough picture of the CPU board. Almost hidden behind it is the terminal board. Two cables plug into the CPU board at the upper-left corner as you're facing it. The lower should be P514.

In P514, the signal from the CPU comes to the yellow wire at the top (hole 10). (The wire coming from hole 10 goes down to P202-4 on the video board in order to connect to the original brightness-control pot there.) You can splice the hook-up wire into this wire. The hook-up wire should preferably be stranded and yellow to match the wire it will be spliced into.

You can, if you wish, cut the yellow wire and splice the auto-brightness control into it. Or, to be neater, you can remove the wire from hole 10 and connect the control directly there, with only one solder connection to the yellow wire. Removing the wire presently in hole 10, the collector of the auto-brightness control should be connected into hole 10; the emitter should be connected to the wire you've just removed.

(If you have an older H/Z19 terminal, you'll want to splice the auto-brightness control into the wire coming out of the terminal board's P401, hole 10.)

Things are equally simple if you have

a newer version '89, with the external control. The best splicing location may require temporarily removing the CPU board, though.

Figure 6b can be used as a guide for the newer versions. It shows just the terminal board, with the CPU board removed from in front of it.

With newer versions, your system should still look much as it does in Figure 6a. Just follow the wires from the top plug over the top of the CPU board. They connect into a plug at the upper left of the terminal board; this should be P401.

The main difference between the older and newer versions is that on the newer versions a black coaxial cable comes up from the external brightness control; it goes around the side or over the top of the terminal board and connects into hole 11 of P401. (From hole 11, circuitry on the back of the board connects to P902-4 on the video-driver board.)

You have to insert the hook-up wire at some point in that shielded cable. Since P401 is hidden behind the CPU board, you might want to take out the CPU board to get clear access to this plug. Then you could solder lead A (the emitter) to the center conductor of the shielded cable; and put lead B (the collector) in hole 11 in place of the center conductor.

Alternatively, you could just cut the cable where it passes over the top or around the side of the terminal board. Then connect B to the side going to the socket and A to the side going to the external control. This is a lot less tidy than the first method. And you would have to reconnect the shield from one side of the cut to the other. (Don't overlook that. It shields the board from interference from signals running on the center conductor.)

Still a third way is to make the insertion down at lug 1 of the original brightness control. (The wiper, lug 2, goes to the video driver; lug 3 goes to ground.) Then you could run the hook-up around the base to the bezel.

Whichever way you choose, be sure that the wire attached to the emitter of Q1 goes to the video-driver circuit. If you got them reversed accidentally, no harm would be done; and you would discover it easily enough on check-out.

Splicing the wires is just a matter of stripping off some insulation and twisting the wires together. Apply solder sparingly to assure a perfect electrical connection. Finish the splice by wrapping it with electrical tape.

Install Q1-R1 from the back of the '89's bezel so that the clear end of the photo-transister just protrudes from the hole. If done properly, it will have a factory-installed appearance. Hold the assembly in place while applying silicone glue to the back side of Q1 and its hole. Continue holding it (or tape it in place) until the glue is set. (Hot-melt glue works just as well and sets in less than a minute.)

Calibration—easier done than said

When the glue is firm, turn on the '89. The process of calibrating the auto-adjusting brightener is mostly a matter of trial and error, and is actually easier to do than to describe. Here is the procedure:

1. Adjust R1 to the limit of its movement—to give the brightest possible display. It might be darker than you like—don't worry about that now. Note that the brightness of the light falling on Q1 should cause the screen brightness to vary slightly. If the screen brightness doesn't change in this way, you may have spliced Q1-R1 into the video circuit backwards. Check that the emitter of Q1 goes to the video board, not to the terminal board.

2. Arrange for the '89 to be in a brightly lit situation, preferably under the identical circumstances in which it will be used. If you get a bright morning light, then make the next adjustment on a bright morning.

3. Adjust the '89's brightness control to the level you find comfortable under these bright conditions of ambient lighting.

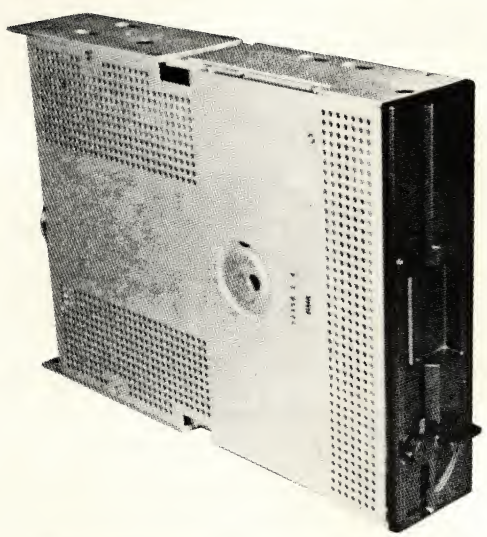
4. Put your finger over Q1 and see if the screen dims to a level appropriate for your dimmest lighting situation.

5. If it doesn't, adjust R1 back a bit to get a dimmer display. Then jump back to step three.

Continue going through steps three through five until you find a combination where the screen is just right under both conditions. At this point you're through.

Close up the '89—and if you have a model with a back-panel brightness control, it wouldn't hurt to immobilize it. Remove the knob and lock the shaft with a dab of nail polish at the point where it emerges from its collar. This may discourage Unauthorized Persons from adjusting the brightness to a screen-burning intensity.

In actual use, I have found that the self-adjusting brightness controller tracks unnoticeably through the day. Once in a while, such as when someone leans over my shoulder to look at the screen, the photo-transistor momentarily dims the screen slightly on an otherwise bright day. On the whole, however, the freedom from wrestling with that interior brightness control twice a day (or more!) has repaid the time and money invested many times over.



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Circle #132 on Reader Service Card

SYMON Says: Challenge Your Memory

This adaptation of an electronic game comes in three versions of BASIC.

Edward A. Byrnes

One day, while cleaning the basement, I came across a small multicolored flying saucer. The saucer turned out to be one of the early electronic games. It was a toy that one of my sons had played with when he was five; and it went by the name Simon.

It didn't work any more, so I tossed it into a spare-parts box and continued sweeping up sawdust and putting tools away. While sweeping, I remembered that Simon had been quite a bit of fun; I wondered about a program that might employ some of the fun elements found in Simon.

The result of this wondering is SYMON.BAS, a challenging memory game program which will run on the H8, the H/Z89, and the H/Z100-series computers. A Z-BASIC version (Listing 1) is shown here to run SYMON under the Zenith Disk Operating System (Z-DOS). A Microsoft BASIC version (Listing 2) runs under CP/M on the '89 and H8; it also runs on the '100 under CP/M–85. With a few modifications, discussed toward the end of the article, the program will also run under the Heath Disk Operating System (HDOS).

For those not familiar with the electronic toy, Simon is a plastic saucer-shaped unit, with large lenses of different colors along the inside of the circumference of the device. Each colored lens is also a momentary contact switch; and there is a small light bulb inside each lens.

A small computery gadget (processor) inside Simon would start the game by briefly and randomly lighting a bulb in one of the plastic lens "buttons." At the same time, a tone with a pitch corresponding to the lit button would be generated. The game player would then press the button that had lit up. Simon would again light the original button and another randomly chosen button.

The game would continue to add a button at each stage. If Simon lit a red-orange-blue sequence, the game player would have to press the red, orange, and blue buttons in the same order as they were generated. If the game player repeated a sequence of 10 or 12 buttons, then the game was won.

SYMON.BAS works in a similar way (except that it is not limited to sequences of 10 or 12). In the Z-BASIC version, colored circles appear on the screen in random sequence and in random locations. The MBASIC version does much the same, but uses various shapes instead of the colored circles. The player must remember the ever-increasing sequence and re-enter the sequence—with the function keys in the Z-BASIC version, and with letters in the MBASIC version. As given in Listings 1 and 2, SYMON's maximum sequence is 49 characters.

At each stage, the sequence of circles or shapes is repeated and another circle or shape is added to the sequence. But the circles and shapes do not appear in the same place on the screen each time they are generated. (This will make much more sense once the game is played a few times.)

Each time a circle or shape appears on the screen, the computer beeps. And upon completion of a re-entered sequence, the computer beeps once for each element of the completed sequence. The beeping of the computer provides interest and adds a bit of anxiety to the game. Fast action is also provided by use of the INPUT$(X) command to read keyboard input instead of requiring the user to hit the carriage return after each letter or sequence.

Generating a 49-character string composed of seven elements

The first task we give the computer is to generate and remember a random sequence. This goal is accomplished by the generation of a 49-character string.

The 49-character string is M$ in the Z-BASIC version. (See lines 300 and 310.) And it's MM$ in the MBASIC version. (See lines 120 and 130.)

The lines referred to consist of two FOR... NEXT... loops, one nested inside the other. Each time a loop is executed, a new random value for the variable B is generated.

Listing 1. The Z-BASIC version of SYMON.BAS. Note that the XORs are specified in lines 450–510. XOR is the default mode for PUT, so these may be omitted from your listing if you wish to save a bit of typing. (See the text for an explanation of XOR's effect.)

```
10 REM ****ZBASIC VERSION****HEADING AND INSTRUCTIONS PROMPT*******************
20 CLS:LOCATE 4,26:COLOR 3,0:PRINT "SYMON...a memory game.":LOCATE 6,28
30 PRINT "Created May 1984":LOCATE 9,21:PRINT "Edward A. Byrnes INTUITIVE LOGIC"
40 LOCATE 13,21:PRINT "Do you want instructions (Y/N)?"
50 ZZ$=INKEY$:IF (ZZ$="Y") OR (ZZ$="y") THEN GOSUB 580:GOTO 70
60 IF (ZZ$="N") OR (ZZ$="n") THEN 100 ELSE 50
70 LOCATE 20,28:PRINT "Do you wish to play (Y/N)?"
80 ZZ$=INKEY$:IF (ZZ$="Y") OR (ZZ$="y") THEN 100
90 IF (ZZ$="N") OR (ZZ$="n") THEN END ELSE 80
100 CLEAR:COLOR 6,0:CLS:N=300
110 REM ******************* ASSIGN FUNCTION KEY VARIABLES *********************
120 KEY 1,"A":KEY 2,"B":KEY 3,"C":KEY 4,"D":KEY 5,"E":KEY 6,"F":KEY 7,"G"
130 REM ************************ DRAW GAME BOARD *******************************
140 LINE(0,0)-(639,170),7,B:LINE(94,190)-(546,215),7,B
150 CIRCLE(128,202),15,1:PAINT(128,202),1,1:COLOR 0,1:LOCATE 23,16:PRINT "F1"
160 CIRCLE(192,202),15,2:PAINT(192,202),2,2:COLOR 0,2:LOCATE 23,24:PRINT "F2"
170 CIRCLE(257,202),15,3:PAINT(257,202),3,3:COLOR 0,3:LOCATE 23,32:PRINT "F3"
180 CIRCLE(321,202),15,4:PAINT(321,202),4,4:COLOR 0,4:LOCATE 23,40:PRINT "F4"
190 CIRCLE(384,202),15,5:PAINT(384,202),5,5:COLOR 0,5:LOCATE 23,48:PRINT "F5"
200 CIRCLE(449,202),15,6:PAINT(449,202),6,6:COLOR 0,6:LOCATE 23,56:PRINT "F6"
210 CIRCLE(512,202),15,7:PAINT(512,202),7,7:COLOR 0,7:LOCATE 23,64:PRINT "F7"
220 COLOR 6,0:O=O+1:IF O>1 THEN 300
230 REM ******************* DIMENSION AND GET CIRCLES **************************
240 DIM A#(37):GET(110,195)-(150,210),A#:DIM B#(37):GET(175,195)-(215,210),B#
250 DIM C#(37):GET(240,195)-(280,210),C#:DIM D#(37):GET(304,195)-(344,210),D#
260 DIM E#(37):GET(367,195)-(407,210),E#:DIM F#(37):GET(432,195)-(472,210),F#
270 DIM G#(37):GET(495,195)-(535,210),G#
280 REM ******************* GENERATE RANDOM SEQUENCE ***************************
290 LOCATE 2,17,0
300 FOR D=0 TO 6:RANDOMIZE VAL(RIGHT$(TIME$,2)):FOR E=0 TO 6:B=INT(RND*7)
310 M$=M$+CHR$(65+B):NEXT E:NEXT D
```

→

In line 300 of the Z-BASIC version, the random-number generator is "reseeded" by looking at the "seconds" value of the TIME$ statement:

RANDOMIZE VAL(RIGHT$(TIME$,2))

In line 120 of the MBASIC version, RANDOMIZE PEEK(11) reseeds the random-number generator by looking at the value in the tic counter of address location 11.

By reseeding every time the loops are executed, we're ensuring that the values generated are fairly pure random values.

In both versions, the expression

B=INT(RND*7)

provides that the value of B will be any integer from 0 to 6, so that CHR$(65+B) will be anything between CHR$(65) and CHR$(71). CHR$(65) through CHR$(71) are the character-string decimal equivalents of the letters A through G: CHR$(65) equals A, CHR$(66) equals B, etc.

Every time the loops are executed, one new letter is added to M$ (or MM$). This is done by the expression M$=M$+CHR$(65+B) in the Z-BASIC version (line 310); and by MM$=MM$+CHR$(65+B) in the MBASIC version (line 130).

The loops are executed seven times each, so the 7 times 7 loop generates the 49-character string M$ (MM$).

The graphic structure

So the computer has generated a random sequence of 49 characters using seven elements (letters A through G). Now, we have to provide a graphic structure that can be manipulated according to the sequence of letters generated in M$ (MM$). If the first letter in the sequence is "B", for example, we want the computer to follow a certain set of commands; if the first letter is "D", we want the computer to follow another set of commands. We also want to see the results of these commands in graphic form on the screen.

Note: I find video layout sheets to be an invaluable aid for keeping track of the graphics in all programs. For the H8 and H/Z89, video layout sheets are available from PC&J Graphics of Deer Park, New York. For about ten cents a sheet, the sheets are well worth having. [Video layout sheets for the Z100 are available from Teach Tech. For ordering information, see "Supplier Notes," page 104.]

I make my own Z100 video layout sheets using graph paper that is marked in millimeters.

To make your own, divide the paper every five millimeters across the top and every ten millimeters down the side. Extend the side and bottom of the graph paper with cut pieces so that it will be 320 millimeters across the top and 225 millimeters down the side. Then both the horizontal five-millimeter divisions and the vertical ten-millimeter divisions can be numbered by tens. This will give 640 units across the top and 225 units

```
320 REM ****************** PUT CIRCLES RANDOMLY ON BOARD ***********************
330 FOR X=1 TO 100:FOR T=1 TO X
340 RANDOMIZE VAL(RIGHT$(TIME$,2))
350 A=(RND*585)+15:D=(RND*140)+10:GOSUB 360:NEXT T:GOSUB 520:NEXT X
360 IF MID$(M$,T,1)="A" THEN BEEP:GOSUB 450:FOR C=1 TO N:NEXT C:GOSUB 450
370 IF MID$(M$,T,1)="B" THEN BEEP:GOSUB 460:FOR C=1 TO N:NEXT C:GOSUB 460
380 IF MID$(M$,T,1)="C" THEN BEEP:GOSUB 470:FOR C=1 TO N:NEXT C:GOSUB 470
390 IF MID$(M$,T,1)="D" THEN BEEP:GOSUB 480:FOR C=1 TO N:NEXT C:GOSUB 480
400 IF MID$(M$,T,1)="E" THEN BEEP:GOSUB 490:FOR C=1 TO N:NEXT C:GOSUB 490
410 IF MID$(M$,T,1)="F" THEN BEEP:GOSUB 500:FOR C=1 TO N:NEXT C:GOSUB 500
420 IF MID$(M$,T,1)="G" THEN BEEP:GOSUB 510:FOR C=1 TO N:NEXT C:GOSUB 510
430 RETURN
440 COLOR 6,0:LOCATE 1,1:END
450 PUT(A,D),A#,XOR:RETURN
460 PUT(A,D),B#,XOR:RETURN
470 PUT(A,D),C#,XOR:RETURN
480 PUT(A,D),D#,XOR:RETURN
490 PUT(A,D),E#,XOR:RETURN
500 PUT(A,D),F#,XOR:RETURN
510 PUT(A,D),G#,XOR:RETURN
520 REM****************** CHECK FOR CORRECT SEQUENCE ************************
522 TT=TT+1
530 ZZ$=INPUT$(X):IF ZZ$=MID$(M$,1,X) THEN GOSUB 670:GOTO 560
550 IF ZZ$<>MID$(M$,1,X) THEN GOSUB 680 ELSE 530
560 RETURN
570 REM ************************ INSTRUCTIONS ******************************
580 CLS:LOCATE 5,17
590 COLOR 2,0:PRINT "A colored circle will appear briefly on the screen,"
600 LOCATE 6,17:PRINT "press the fuction key that corresponds to its color"
610 LOCATE 7,17:PRINT "...the first circle will appear again and then a "
620 LOCATE 8,17:PRINT "second, press the function key that corresponds to the"
630 LOCATE 9,17:PRINT "first and second colored circle...in sequential order."
640 LOCATE 10,17:PRINT "Continue in this way until you run out of memory."
650 RETURN
660 REM ****************** RING BELL IF SEQUENCE IS CORRECT ********************
670 FOR C=1 TO X:BEEP:FOR S=1 TO 100:NEXT S:NEXT C:FOR C=1 TO 200:NEXT C
672 IF TT=49 THEN GOTO 676
674 RETURN
676 LOCATE 3,20:PRINT "!!!!YOU WON!!!!"
678 LOCATE 5,12:PRINT "YOU REMEMBERED A SEQUENCE OF";X;"
679 LOCATE 7,12:PRINT "DO YOU WANT ANOTHER GAME (Y/N)?":GOTO 690
680 PRINT "YOU REMEMBERED A SEQUENCE OF";X-1;"...TRY AGAIN (Y/N)?"
690 J$=INPUT$(1):IF (J$="Y") OR (J$="y") THEN 100:RETURN
700 IF (J$="N") OR (J$="n") THEN CLS:LOCATE ,,1:FILES:END
710 IF (J$<>"Y") OR (J$<>"N") OR (J$<>"y") OR (J$<>"n") THEN 690
720 RETURN
```

Listing 2. The Microsoft BASIC version of SYMON.BAS, written and tested under MBASIC version 5.22 (created 19 March, 1982) and CP/M 2.2x03. For convenient printing here, the 78 z's in line 760 and the 76 z's in line 790 were broken. These could be typed in to your editor as long lines, or they can be broken in CP/M MBASIC with the LINE FEED.

```
10 REM ****CP/M MBASIC VERSION****H89 EQUATES**********************************
20 CLEAR:Z$=CHR$(27):Y$=CHR$(89):K$=Z$+Y$:X$=CHR$(70):W$=CHR$(71):M$=CHR$(120)
30 N$=CHR$(121):V$=CHR$(75):R$=Z$+V$:CLS$=Z$+"E":PRINT CLS$:N=75:TT=0
40 REM ****************HEADING AND INSTRUCTIONS PROMPT************************
50 PRINT Z$W$;:PRINT Z$M$CHR$(53);:REM (Print reg. characters turn cursor off.)
60 PRINT K$CHR$(34)CHR$(55)"SYMON...a memory game."
70 PRINT K$CHR$(37)CHR$(49)"Edward A. Byrnes  INTUITIVE LOGIC"
80 PRINT K$CHR$(40)CHR$(52)"Do you want instructions (Y/N)?"
90 ZZ$=INPUT$(1):IF (ZZ$="N") OR (ZZ$="n") THEN PRINT CLS$:GOSUB 290:GOTO 110
100 IF (ZZ$="Y") OR (ZZ$="y") THEN GOSUB 800:GOSUB 290 ELSE GOTO 90
110 REM ****************GENERATE RANDOM SEQUENCE******************************
120 FOR D=0 TO 6:RANDOMIZE PEEK(11):FOR E=0 TO 6:B=INT(RND*7)
130 MM$=MM$+(CHR$(65+B)):NEXT E:NEXT D
140 REM ****************DRAW GAME BOARD***************************************
150 GOSUB 290:GOSUB 750
160 FOR X=0 TO 6:A=52:D=(52+5*X):IF X=0 THEN GOSUB 520
170 IF X=1 THEN GOSUB 550
180 IF X=2 THEN GOSUB 580
190 IF X=3 THEN GOSUB 610
200 IF X=4 THEN GOSUB 640
210 IF X=5 THEN GOSUB 670
220 IF X=6 THEN GOSUB 700
230 NEXT X
240 REM ***************PUT SHAPES RANDOMLY ON BOARD*************************
250 FOR X=1 TO 100
260 FOR T=1 TO X:RANDOMIZE PEEK(11):A=34+(15*RND(1)):D=32+(70*RND(1))
270 GOSUB 330:NEXT T:GOSUB 412:NEXT X
280 PRINT Z$W$:PRINT Z$N$CHR$(53):END:REM (Graphics off and end.)
290 PRINT Z$X$:PRINT Z$M$CHR$(53);:RETURN:REM (Graphics on and cursor off.)
300 PRINT Z$W$:PRINT Z$N$CHR$(53);:RETURN:REM (Graphics off and cursor on.)
310 PRINT Z$CHR$(112);:RETURN:REM (Reverse video on.)
320 PRINT Z$CHR$(113);:RETURN:REM (Reverse video off.)
330 IF MID$(MM$,T,1)="A" THEN GOSUB 740:GOSUB 520:FOR C=1 TO N:NEXT C:GOSUB 730
340 IF MID$(MM$,T,1)="B" THEN GOSUB 740:GOSUB 550:FOR C=1 TO N:NEXT C:GOSUB 730
350 IF MID$(MM$,T,1)="C" THEN GOSUB 740:GOSUB 580:FOR C=1 TO N:NEXT C:GOSUB 730
360 IF MID$(MM$,T,1)="D" THEN GOSUB 740:GOSUB 610:FOR C=1 TO N:NEXT C:GOSUB 730
370 IF MID$(MM$,T,1)="E" THEN GOSUB 740:GOSUB 640:FOR C=1 TO N:NEXT C:GOSUB 730
380 IF MID$(MM$,T,1)="F" THEN GOSUB 740:GOSUB 670:FOR C=1 TO N:NEXT C:GOSUB 730
390 IF MID$(MM$,T,1)="G" THEN GOSUB 740:GOSUB 700:FOR C=1 TO N:NEXT C:GOSUB 730
400 RETURN                                                                  →
```

```
410 REM ****************CHECK FOR CORRECT SEQUENCE****************************
412 TT=TT+1
420 ZZ$=INPUT$(X):IF ZZ$=MID$(MM$,1,X) THEN GOSUB 460:GOTO 450
440 IF ZZ$<>MID$(MM$,1,X) THEN GOSUB 480 ELSE 420
450 RETURN
460 FOR C=1 TO X:PRINT CHR$(7);:FOR S=1 TO 50:NEXT S:NEXT C:FOR C=1 TO 200
470 NEXT C
471 IF TT=49 THEN GOTO 475
473 RETURN
475 PRINT K$CHR$(40)CHR$(50)"!!!!YOU WON!!!! YOU REMEMBERED A SEQUENCE OF";X;"!"
477 PRINT K$CHR$(41)CHR$(65)"...PLAY AGAIN (Y/N)?":GOTO 490
480 PRINT K$CHR$(40)CHR$(45)"YOU REMEMBERED A SEQUENCE OF";X-1;"...AGAIN (Y/N)?"
490 J$=INPUT$(1):IF (J$="Y") OR (J$="y") THEN 10
500 IF (J$="N") OR (J$="n") THEN PRINT CLS$:FILES:GOTO 280
510 IF (J$<>"Y") OR (J$<>"N") OR (J$<>"y") OR (J$<>"n") THEN 490
520 REM 'A SHAPE'
530 GOSUB 310:PRINT K$CHR$(A)CHR$(D)"r "CHR$(95):PRINT K$CHR$(A+1)CHR$(D)" A "
540 GOSUB 320:RETURN
550 REM 'B SHAPE'
560 GOSUB 310:PRINT K$CHR$(A)CHR$(D)"   ":PRINT K$CHR$(A+1)CHR$(D)" B "
570 GOSUB 320:RETURN
580 REM 'C SHAPE'
590 GOSUB 310:PRINT K$CHR$(A)CHR$(D)" ":PRINT K$CHR$(A)CHR$(D+2)" "
600 PRINT K$CHR$(A+1)CHR$(D)" C ":GOSUB 320:RETURN
610 REM 'D SHAPE'
620 GOSUB 310:PRINT K$CHR$(A)CHR$(D)CHR$(95):PRINT K$CHR$(A+1)CHR$(D)" D "
630 GOSUB 320:RETURN
640 REM 'E SHAPE'
650 GOSUB 310:PRINT K$CHR$(A)CHR$(D+2)" ":PRINT K$CHR$(A+1)CHR$(D)" E "
660 GOSUB 320:RETURN
670 REM 'F SHAPE'
680 GOSUB 310:PRINT K$CHR$(A)CHR$(D)"r":PRINT K$CHR$(A)CHR$(D+2)CHR$(95)
690 PRINT K$CHR$(A+1)CHR$(D)" F ":GOSUB 320:RETURN
700 REM 'G SHAPE'
710 GOSUB 310:PRINT K$CHR$(A)CHR$(D)"   ":PRINT K$CHR$(A+1)CHR$(D+1)"G "
720 GOSUB 320:RETURN
730 GOSUB 320:FOR R=0 TO 1:PRINT K$CHR$(A+R)CHR$(D)"   ":NEXT R:RETURN
740 PRINT CHR$(7);:RETURN
750 REM ********************DRAW GAME BOARD************************************
760 PRINT K$CHR$(32)CHR$(32)"zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
    zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz"
770 FOR X=1 TO 18:PRINT K$CHR$(32+X)CHR$(32)"}":PRINT K$CHR$(32+X)CHR$(109)"¦"
780 NEXT X
790 PRINT K$CHR$(51)CHR$(33)"zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz
    zzzzzzzzzzzzzzzzzzzzzzzzzzzzzzz":RETURN
800 REM ********************INSTRUCTIONS*************************************
810 PRINT CLS$
820 PRINT K$CHR$(40)CHR$(48)"A lettered shape will appear briefly on the"
830 PRINT K$CHR$(41)CHR$(48)"screen. Press the capital letter that corresponds"
840 PRINT K$CHR$(42)CHR$(48)"to its shape. The first shape will appear again"
850 PRINT K$CHR$(43)CHR$(48)"and then asecond. Press the letter for the first"
860 PRINT K$CHR$(44)CHR$(48)"shape and the second shape...in sequential order."
870 PRINT K$CHR$(45)CHR$(48)"Continue in this way until you run out of memory."
880 PRINT K$CHR$(47)CHR$(60)"Do you wish to play (Y/N)?"
890 ZZ$=INPUT$(1):IF (ZZ$="Y") OR (ZZ$="y") THEN PRINT CLS$:RETURN
900 IF(ZZ$="N") OR (ZZ$="n") THEN PRINT CLS$:END ELSE 890
```

down the side—the dot resolution of the '100's screen.

Once you have the original made, find a "ledger-size" copier and make as many copies as you need. Everything drawn on these sheets will appear in the proper vertical to horizontal proportions when written to the screen.

The boundaries of the playing area of the screen are defined in line 140 of the Z-BASIC version. This is done by the first LINE statement:

```
LINE(0,0)-(639,170),7,B
```

There, (0,0) and (639,170) define the upper-left and lower-right corners of a rectangle. The ",7" tells the computer to use the color white. And the ",B" of the statement tells the computer that this is a rectangle (box) that is wanted—and not a diagonal line—from 0,0 to 639,170.

The playing area is defined in the MBASIC version in lines 760-790. If you examine the definition of variables in line 20 of the MBASIC version, you will see that line 760:

```
760 PRINT K$CHR$(32)CHR$(32)"zzzz. . ."
```

is equal to:

```
760 PRINT CHR$(27)CHR$(89)CHR$(32)
  CHR$(32)"zzz. . ."
```

By the definitions in line 20, K$ is equal to Z$+Y$, and Z$ is equal to CHR$(27), while Y$ is equal to CHR$(89).

So PRINT K$—PRINT CHR$(27)CHR$(89)—tells the computer that the cursor should get ready to go to a specific row and column. "CHR$(32)CHR$(32)" tells the computer that the specific row and column is row 1 and column 1. (32 is the decimal value of row or column 1.)

The z's specify what the computer is to PRINT starting at the specified row and column. In this case, it is a number of small horizontal lines (the graphic form of lowercase "z").

The defining of variables as in line 20 can be carried many steps further. We could add the following to line 20:

```
A$=CHR$(32):C$="zzz. . .":
  GH$=K$+A$+A$+C$
```

Then the lines below would all be equal to line 760 in Listing 2 and would direct identical program execution in the MBASIC version:

```
1) PRINT CHR$(27)CHR$(89)CHR$(32)
   CHR$(32)"zzz. . ."
2) PRINT Z$Y$CHR$(32)CHR$(32)"zzz. . ."
3) PRINT K$CHR$(32)CHR$(32)"zzz. . ."
4) PRINT K$A$A$C$
5) PRINT GH$
```

(*Note:* Through trial and error, I have had the most luck using form 3 of the equivalent lines. Form 3 tells me enough to keep track of what I am printing to the screen and where I am printing it.)

To complete the playing area of the MBASIC version, two vertical lines are drawn on the screen by the loop in line 770; and another horizontal line is drawn by line 790.

Graphic game pieces

In the Z-BASIC version of SYMON, the playing pieces are colored circles, created by the CIRCLE and PAINT commands (lines 150-210).

"CIRCLE(128,202),15,1" in line 150, for instance, tells the computer that we want a circle drawn with a center at pixel coordinates 128 across and 202 pixels down; the ",15" tells the computer that we want the circle to have a radius of 15; and the ",1" tells the computer that we want the circle drawn in blue.

In the same line, "PAINT (128, 202),1,1" tells the computer to start painting from the center of the previously defined circle; the first ",1" tells the computer to paint in the color blue; and the second ",1" tells the computer to paint until it comes to the blue border of the circle.

Lines 150-210 in the Z-BASIC version are executed when the game is started; at that time, a blue, a green, a cyan, a red, a magenta, a yellow, and a white circle appear in a row under the defined playing area of the game. The LOCATE command's row and column coordinates define the approximate center of each colored circle. And the PRINT command prints one of the function-key symbols F1 through F7 on each circle.

In the MBASIC version, small shapes appear on the screen under the playing board. Lines 520-730 of the MBASIC version are GOSUBs that print the shapes and their corresponding letters A through G when the game is started; they are called by lines 160-220.

(During the actual play of the game, these GOSUBs will be called by lines 330-390 depending on the random number generated, and placed randomly on the playing field.)

Examination of lines 520-730 shows that we must provide the decimal equivalents of the row (variable A—across) and column (variable D—down) before each GOSUB is referenced.

In line 160, we define the variable A as 52. This is the decimal equivalent of row 21. We also define the variable D as equal to (52+5*X). Each time the loop is executed, the row coordinate (A) remains the same while the column coor-

dinate (D) increases. So upon completion of the loop, we have the decimal equivalents of columns 21, 26, 31, 36, 41, 47, and 53. These coordinates are supplied before the GOSUBs are executed.

Execution is directed to a different GOSUB (dependent upon the value of X) each time the loop is executed. So, we end up with a row of seven different shapes, each one labelled with one letter, A through G. The shapes are then printed just below the playing area of the MBASIC version of SYMON.

Moving the pieces around

So, the playing area is defined; and a "key" of colored circles or shapes appears below the playing area. Now, we must be able to make the colored circles or shapes appear momentarily within the playing field.

In the Z-BASIC version of SYMON, we use the DIMension, PUT, and GET commands to accomplish this task.

The DIM statements in lines 240-270 set aside a small storage area in memory. In the statement DIM A#(37), we label the memory area as A# so that we can refer to that particular area of memory farther along in the program. The (37) defines the capacity of storage area A#.

The GET statement in each line defines the area of an already-created graphic display that we wish to place in the previously DIM-defined area of memory. Take the first such GET statement as an example:

GET(110,195)-(150,210),A#

There, (110,195) and (150,210) are the coordinates that define the upper-left and lower-right corners of a rectangle. The ",A#" tells the computer to save the image defined by our coordinates in the GET statement and place it in the storage area labelled A#.

The capacity of the storage area has to be large enough to accommodate the image to be stored. The Z-BASIC manual gives the formula to calculate its size requirements:

4+INT((X+7)/8)*3*Y

There, X is the number of pixels across the area you want to store; and Y is the number of pixels down. In our example, X would be (150–110)+1, or 41; and Y would be (210–195)+1, or 16.

Plugging these values into the formula, we would have:

4+INT((41+7)/8)*3*16
= 4+INT(6)*48
= 4+6*48
= 4+288
= 292

By using the "#" sign in A#, we declare double-precision. The 292 bytes will be stored in A#( ). Each element's double-precision value accounts for eight bytes in memory. Therefore, we must divide 292 by eight to get the number of elements in our array. This gives us 36.5, which we round off to 37—which is why we defined the capacity of storage area #A as 37.

(Note: To save time and depending on the size of the image to be stored, I start with an arbitrary capacity value in the DIM statement and then run the program. If I get an ILLEGAL FUNCTION CALL, I know the value I've used is too small and I add ten to the value. If I then run the program and get no error message, I subtract until the error message shows up again. By this process of elimination, I arrive at a fine working value for the DIM statement in half the time it takes me to calculate the formula using MBASIC's direct mode.)

The pixel coordinates in the GET commands in lines 240-270 (Z-BASIC version) define small rectangles surrounding each of the colored circles. So the image of each circle is placed in its own labelled storage area for future reference.

To place the circles in the playing area, we use the PUT command. Lines 450-510 place the image from a particular storage area onto the screen.

In line 450's statement:

PUT(A,D),A#,XOR

A and D are the Across and Down pixel coordinates of the upper-left corner of the area where the image saved is to be placed. If (A,D) is (0,0) then the colored circle saved in A# will be centered within a rectangle defined by the pixel coordinates (0,0) and (40,15). Here, (0,0) is the upper-left corner of the screen; and given the size of the box in A#, the lower-right corner will be (40,15). Again the ",A#" in the PUT statement above

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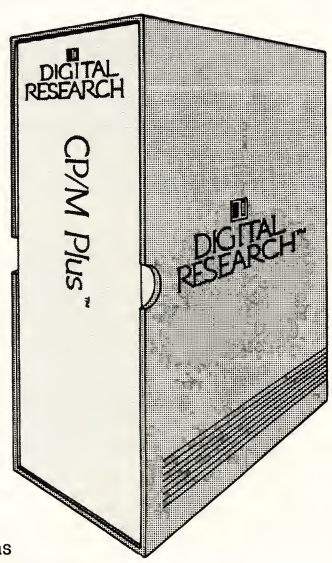

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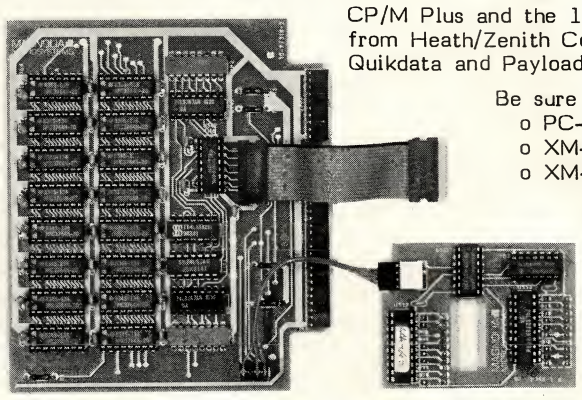

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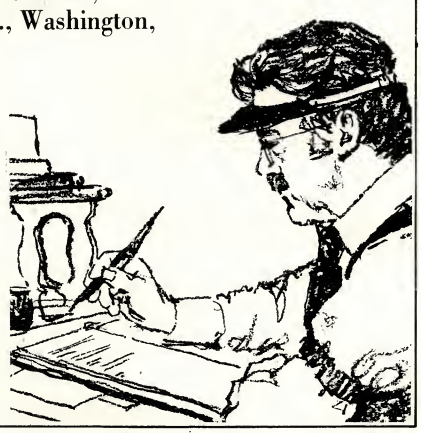

calls the image from the storage area we labelled A#.

The ",XOR" part of the PUT statement causes the image placed on the screen to disappear if it is "PUT" in the same location twice. In other words, the first time the computer encounters the statement

PUT(0,0),A#,XOR

in SYMON.BAS, it places an image of a colored circle in the upper left hand corner of the screen. If at a later time the computer encounters the same statement, then the image of the circle will disappear.

Now we have the mechanics necessary to put a colored circle on the screen and make it disappear again. The Z-BASIC version's lines 330-430 make up a large double loop. In lines 340 and 350, random coordinates are generated. Then in lines 360-420, the 49-character sequence of letters (M$) is checked; and GOSUBs are used to make and take images from the screen.

As each loop is executed, the value of T increases by one. In line 360, the statement

IF MID$(M$,T,1)="A"

checks the sequence of characters in M$. It checks the first character, looking for the occurrence of "A". If "A" is not found, line 370 will check the first character for "B", and so on until one of the lines 360-420 finds its appropriate character.

If an "A" is found, then the rest of line 360 is executed:

THEN BEEP:GOSUB 450:FOR C=1 TO N:NEXT C:GOSUB 450

"THEN BEEP", of course, causes the computer to beep; "GOSUB 450" causes the computer to place the image from A# on the screen at the random coordinates A and D. "FOR C=1 TO N:NEXT C" regulates the time the image stays on the screen; and the final "GOSUB 450" is the second PUT with XOR, which causes the image to disappear.

Each time the value of T increases, the next letter in M$ or MM$ is examined. Each element in M$, or MM$, satisfies one line of lines 360-420 in the Z-BASIC version, or one line of lines 330-390 in the MBASIC version. Therefore, either a colored circle or a shape (depending on the version) is placed randomly on the screen and then erased.

The same basic mechanics are used in the MBASIC version except that we don't save the graphic images (shapes) in memory. In the MBASIC version, the shapes are placed by GOSUBs to lines 520-720 and are erased by a GOSUB to line 730.

In the MBASIC version, the loop in lines 330-400 checks for the occurrence of the letters A-G in the 49-character string MM$.

When an "A" is found in the sequence, for example, line 330 directs execution to line 740; there, the computer beeps. Control is then directed to line 520, where the graphic shape labelled "A" is printed at the random coordinates of A and D generated in line 260.

The shape remains on the screen for the length of time regulated by line 330's "FOR C=1 TO N:NEXT C". And finally, program execution is directed to line 730—which simply erases whatever was printed on the screen at random coordinates A and D.

Checking for the correct entry sequence

The INPUT$(X) command is useful and powerful; it is used in both the Z-BASIC and MBASIC versions of the game. (See lines 530-560 in the Z-BASIC version and lines 420-450 in the MBASIC version.)

First, ZZ$ is defined as INPUT$(X). When an INPUT$(X) command is encountered, program execution stops until X number of characters are typed in at the keyboard or keypad. To satisfy the command "ZZ$=INPUT$(5)" for example, program execution stops until five characters are typed.

IF... THEN... command statements usually follow an INPUT$(X) command; they direct program execution dependent upon what is typed in from the keyboard. In SYMON.BAS, the "CHECK FOR CORRECT SEQUENCE" lines (lines 530-560 in Z-BASIC, lines 420-450 in MBASIC) are GOSUBs; they are jumped to from the loop that produces the graphic sequences.

The value of X increases each time the loop is executed. So, using INPUT$(X), the computer knows that if seven objects have appeared on the screen it must wait for seven keystrokes from the keyboard. In the Z-BASIC version, once X number of characters have been typed, line 530's expression

IF ZZ$=MID$(M$,1,X) THEN GOSUB 670

compares what has been typed in from the keyboard against the first X characters in M$, which is our 49-character sequence. If what is typed matches the first X characters of M$, then the bell is rung X times as execution of the program is directed to GOSUB 670. (In the MBASIC version, program control is directed to line 460, where CHR$(7) rings the bell.)

If what is typed on the keyboard does not match the first X characters of M$, then program execution is directed to the message "YOU REMEMBERED A SEQUENCE OF X". This is done by line 550 in the Z-BASIC version:

IF ZZ$<>MID$(M$,1,X) THEN GOSUB 680 ELSE 530

The MID$ command makes it possible to compare any "substring" of a string; in this case our string is M$ or MM$ depending on the version of BASIC. In "MID$(M$,1,X)" the M$ identifies our 49-character sequence; the ",1" tells the computer to start the checking with the first character of the string; and the ",X" tells the computer to check up to the X numbered character in the string M$. So

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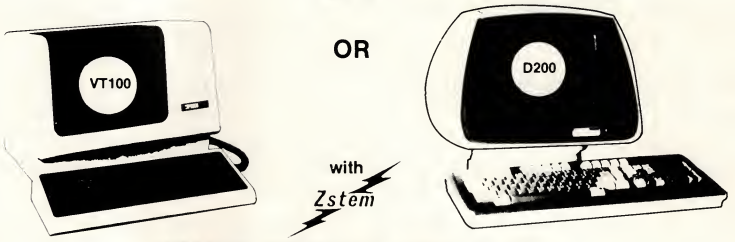

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```
120 FOR D=0 TO 4:FOR E=0 TO 4:B=INT(7*RND(P))
260 FOR T=1 TO X:A=36+(12*RND(P)):D=32+(70*RND(P))
760 PRINT K$CHR$(33)CHR$(33)"zzzz
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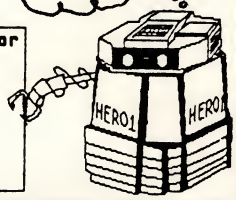

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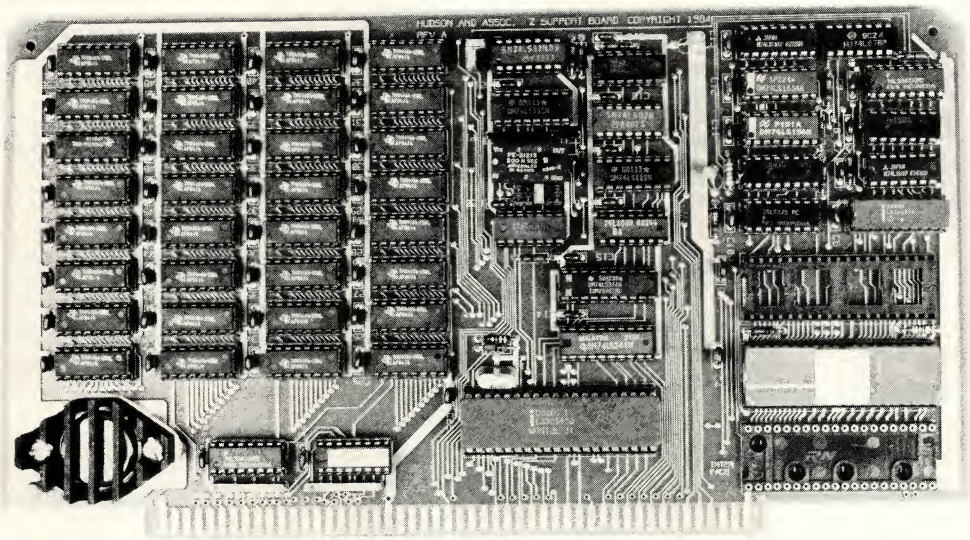

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CHUG and THUG disk libraries

The Capital Heath Users' Group, Inc. (CHUG) operates in the Washington, D.C., area and maintains an extensive disk library for its members. Disks may be ordered by mail, postpaid, for $6 for soft-sectored 5¼" disks in HDOS, CP/M-80, or Z-DOS formats.

CHUG annual membership dues are $12. A disk catalogue is provided to new members. I am pleased with the quality of the Z-DOS programs that I have seen on volumes 170, 212, and 215. It is my intention to review selected programs from these disks in coming issues.

Also, the Tidewater Heath Users' Group (THUG) maintains an extensive disk library at the Virginia Beach Heathkit store. The disks in this library were put together by the New York Amateur Computer Club (NYACC) and by its Special Interest Group, CP/M (SIG/M). These disks are available for copying in the store if you are a member of THUG's "subgroup," the Tidewater CP/M Users' Group. In addition to the THUG membership fee, there is a one-time charge of $15 to become a member the Tidewater CP/M Users' Group.

Many other HUGs around the world have libraries available for members. If you are not a member of some local Heath Users' Group, then what are you waiting for? If there is not a HUG within commuting distance, then I urge you to form one. Your participation will be rewarding and will add to our increasing strength.

I would assume that many readers of *Sextant* are also readers of *REMark*, the official magazine of the national Heath Users' Group. If you're not, by all means join the national HUG and receive *REMark*.

MS-DOS directory programs

There are a host of directory programs, and new versions appear often. You can find a file with any of these utilities, but suppose you have two similar disks and one directory has 97 files and the other 100 files? Sometimes it is tedious to find the files that differ in the directories.

I have on-line four directory programs, each with advantages and disadvantages. Let's talk about them: DIR, DIR150, SD, and ZDIR.

First there is MS-DOS's resident utility DIR. One of its disadvantages is that when the file size is displayed, only 20 files will fit on screen at the same time.

Then there is DIR150, which comes on HUG disk #885-3014-37. This is a compact directory and is able to show up to 80 files per display. DIR150 first displays a graphic frame with vertical separators for four columns; and then it prints the directory a column at a time. The problem is that if there are only a few files in the directory, the whole screen is still used; this precludes showing another directory on the same screen.

Third, there is SD. I have version 3.0, dated 5 September, 1983. It was written by John Stetson, and appears on CHUG disk 215. It can print up to 40 files per screen display and shows the date and time for each file. It has a number of switches and will sort by file extension, date, and file size. It is a very good directory program, but because of its date and time columns, it is not compact. I like SD better than DIR or D. There is also a version of SD written for hierarchical files.

Fourth, there is ZDIR. This is furnished on MS-DOS Distribution Disk I. ZDIR usually prints the left side of the screen first, creating an imbalanced screen whenever fewer than 40 files are displayed. I don't care for any directory utility that prints files a column at a time, wasting space if the directory does not fill up the whole screen. Nor do I like a directory program that cannot display two small directories on the same screen. In short, I think that it should be possible to write better directories than any of the above.

SD SuperDirectory utility

Since I singled out the SD (SuperDirectory) as my preference, I would like to direct your attention to a specific version—although as I write this, I know that yet another version is around the corner. Variations have been written for CP/M, Z-DOS, and MS-DOS operating systems.

SD.COM is customized for the Z100 and will work with MS-DOS versions 1.x or 2.0. It writes the display horizontally, rather than vertically, and thus saves space when fewer than 40 files are present in a directory. It is an excellent and powerful version and contains the following switches:

/b—sort by file size in bytes;
/d—sort by file-creation date & time;
/e—sort by file extension;
/n—use directory order (no sort);
/c—clear screen, then display output;

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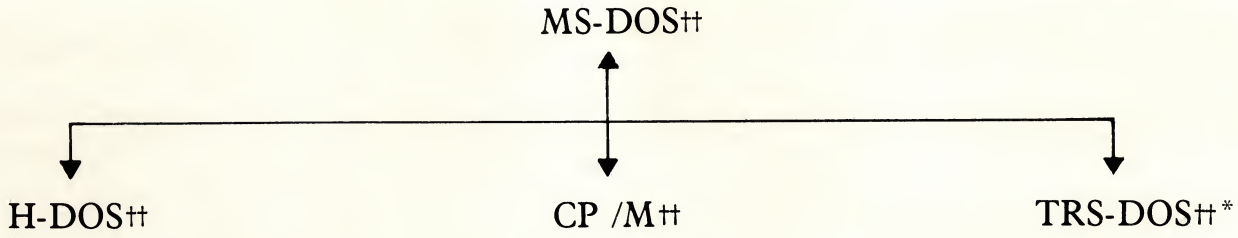

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/q—quick output (no page pauses);
/s—include hidden and system files;
/1—use single-column format;
/x—display command syntax summary;
/t—display only the total number of files and disk space used.

Proposed directory specification

Since I have been somewhat critical of the directory programs mentioned, I owe it to you to set forth the characteristics of a better directory program. In my opinion, a good directory program should be able to hold two sorted directories in memory at the same time. It should be capable of sorting on any field. It should be capable of toggling rapidly between two directories to facilitate comparisons without rereading the disk.

The display should be compact and display files four columns abreast, showing the size of each file. This means that up to 80 files could be listed on one display. It should be capable of showing two 30-file directories one above the other in the four-abreast format. Alternatively, it could use the split-screen technique and show the directories side by side.

If two directories are too large to fit on the screen at the same time, then you should be able to display them in succession by toggling a special function key.

The top line should show the disk-drive designation and the directory name. The bottom line should show the number of files in each directory, the total space used by the files, and the space remaining on each disk. The program should have a paging feature to handle large directories.

Finally, it should be written to be fast. In the past, directory programs had to be kept small, with all the attendant sacrifices in speed and power. With more and more people using greater on-line storage, space is not the limitation it once was. Better directory programs are sure to come.

VFILER file-manager utility

The VFILER program provides an excellent file-management system that works well with both Z-DOS and MS-DOS 2.0. It is available on CHUG disk 215.

VFILER allows the use of the arrow keys to move the cursor quickly from file to file in the directory so that selected files may be tagged or untagged for later deletion, copying, etc. Tagged files appear in color. It is a very friendly program and operates in a way similar to the SWEEP and WASH file-maintenance programs, in which files are tagged for copying, deletion, etc.

It allows the use of wildcards for the initial directory listing, so you can enter VFILER *.COM or VFILER *.BAS, say, to obtain a smaller directory to manage. Credit goes to Mike Nice for conversion of this program from CP/M to an even better Z-DOS/MS-DOS version.

Substitute for RDDOS.CMD

CP/M-86 is furnished with a utility called RDDOS.CMD which may be used to copy Z-DOS or MS-DOS files to CP/M-formatted disks. No similar utility is furnished with CP/M-85. However, a method using DEBUG.COM and CP/M-85's resident SAVE command may be used as a substitute for RDDOS.CMD.

Enter the commands shown below for a neat way of copying MS-DOS ASCII files to a CP/M-85 disk. A

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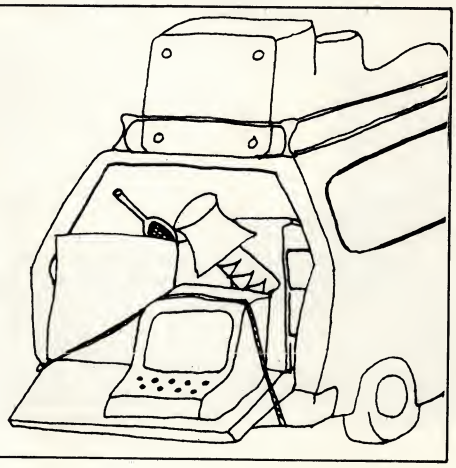


carriage return is indicated by <CR>. "Filespec" indicates drive designation, file name, and extension.

DEBUG <CR> (Loads DEBUG utility into high memory)

NFILESPEC <CR> (Identifies the MS-DOS file you wish to copy to RAM)

L1000:100 <CR> (Loads the file in RAM where CP/M can find it)

Now remove MS-DOS disk(s)

CTRL-RESET

Put CP/M bootable disk in drive and reboot. This does not interfere with the MS-DOS file which was stored in RAM.

SAVE xx FILESPEC <CR> (Use CP/M resident SAVE command to save xx decimal pages of RAM to disk)

The size of both a CP/M and an MS-DOS page is 256 bytes. Divide the size of the file, obtained from DIR, by 256 to determine the number of RAM pages to save to disk. This is the number xx.

Using SPELL on PeachText files

I used the technique described above to copy a PeachText file from an MS-DOS disk to a CP/M-85 disk for the purpose of using The Software Toolworks' SPELL program. In my judgement, the SPELL program is superior to the speller provided with PeachText because of its larger dictionary. After using the SPELL program to mark misspelled words, I used the MS-DOS utility RDCPM to read the file back to an MS-DOS disk; then I used the PeachText editor to search for the marked misspelled words. (Please blame the gremlins for any remaining misspelled words.)

COPY CON YELLOW.BAT

The MS-DOS COPY command is quite versatile, and like CP/M's PIP command, can copy from devices as well as from files. If we like, we may use the COPY CON command to create a batch file to hold control characters. All batch files must have the BAT file extension. When the BAT file is executed, the control characters placed in the file will be sent to the terminal. In this way, we may change colors, modify the cursor, clear the screen, etc. (See the *Z100 User's Manual* for terminal escape codes.)

To give it a try, enter the commands below:

COPY CON YELLOW.BAT <CR> (Prepare to copy from console to file)

F8m60 <CR> (Press F8, m, 6, 0 keys for escape codes)

CTRL-Z <CR> (Press CTRL and Z keys simultaneously)

YELLOW <CR> (Execute YELLOW.BAT)

When YELLOW is executed from the DOS command prompt, the display will have a yellow (6) foreground and a black (0) background. The F8 key sends the escape code—which will appear on screen as a left square bracket.

The idiosyncrasy about the CON command is that the colon must not be used, as is customary with PRN:, A:, B:, etc. Remember, too, that you will fail if you attempt to TYPE the YELLOW.BAT file, because it only contains escape characters. And unfortunately, the few characters in this batch file still consume the minimum 1,024 bytes of disk space on an 8" disk—even though the file name in the directory will show that only 6 bytes were used.

A good directory program should be able to hold two sorted directories in memory.

Z-BASIC timing segments

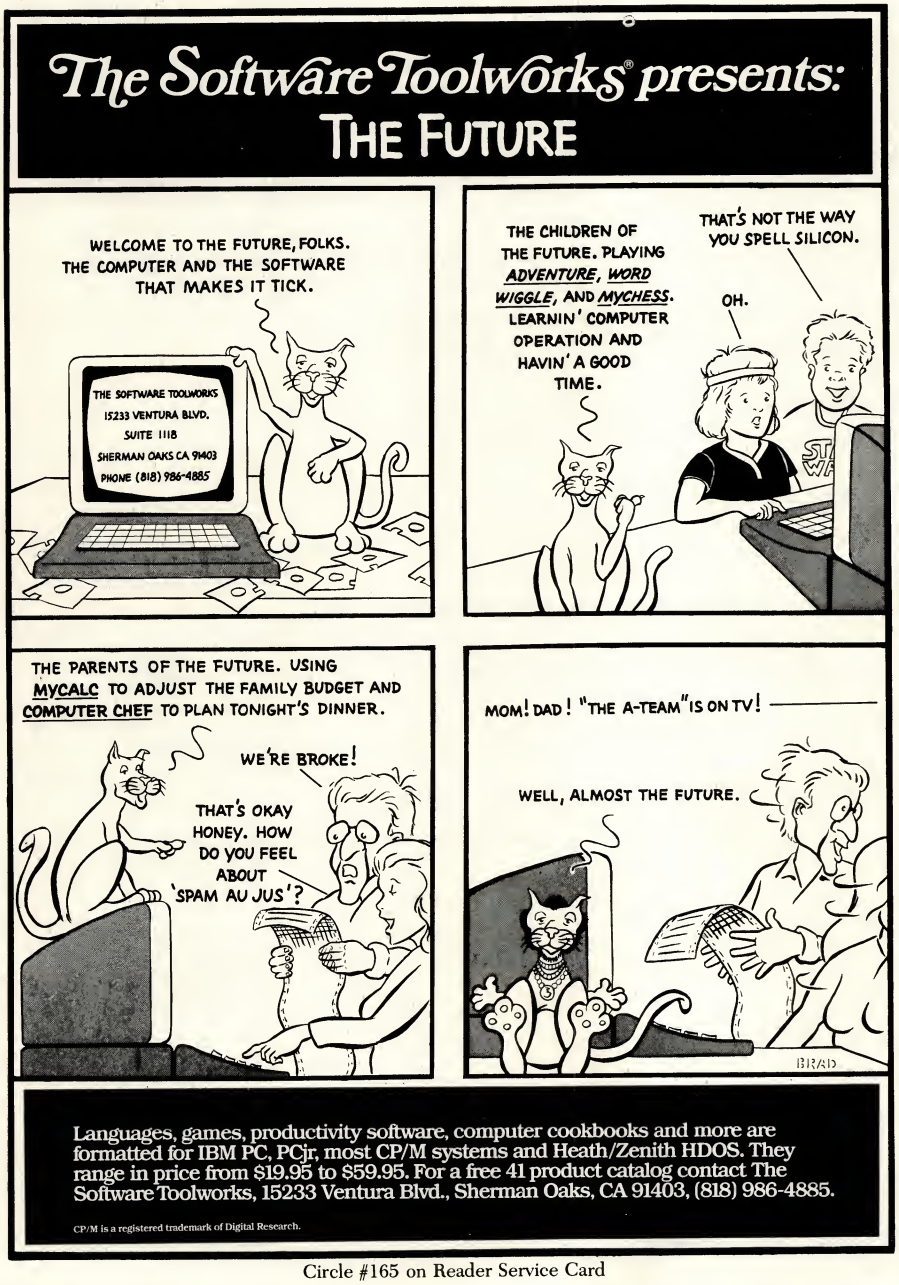
Z-BASIC contains a useful and powerful timing function. With the TIME function, the time to the nearest second will be returned to your program. TIME may be used in two ways. First, it may be used to provide the elapsed time of a session or of a routine. Second, it may be used to sound an alarm after a given interval has passed.

Z-BASIC code to illustrate these two ways of employing the timing function is listed below:

```
10 TIME$="0:0:0": FOR J=1 TO 5000: NEXT:
   PRINT TIME$
20 T=TIME: WHILE T+3<>TIME: J=J: WEND:
   BEEP: PRINT TIME-T
```

Setting the Z100 terminal with the OFFLINE.COM utility

OFFLINE.COM is a very useful Z-DOS/MS-DOS utility found on CHUG disk 212. We can thank Michael J. Cogswell for writing this program. The OFFLINE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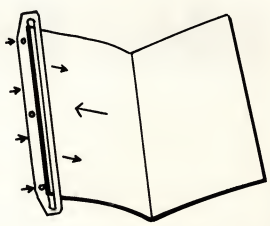

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utility allows Z100 owners to access the terminal functions directly, in a manner similar to using the OFFLINE key on the H89. To exit from OFFLINE, press the HELP key.

To set the Z100 terminal, first execute OFFLINE from the command prompt. Then, for starters, press the ESC key, press the m key, press the 6 key, press the 0 key, and press the HELP key. Now you have set the foreground color to yellow and the background color to black and have returned on-line.

Using this technique, you may change the cursor to block or non-blinking, select any color you like, and do a host of other things to the terminal. (See pages B.14–B.17 in the user's manual for the escape codes to use.)

PATH=C:\BIN;C:\DEVEL

This command sets up a dual search path to access hierarchical directories under version 2 of the Microsoft Disk Operating System (MS-DOS—or simply DOS). The semicolon separates the two paths.

Here is an example of how DOS reacts to the sample command given above. If drive A is logged in and you type "ZBASIC", DOS will search drive A for ZBASIC. If it is not found on drive A, then DOS will search for it according to your path command, first in the BIN directory of drive C. If ZBASIC is not found there, then the DEVEL directory on drive C will be searched.

A path command can be issued from any logged drive. Many paths may be included in the command; but it takes more time for DOS to search all the way to the end of a long path command; so take care to place the most-used paths first. It is only necessary to type the path command once during a session, unless a change in the path is desired.

Even though the dual path command is helpful, it does not accommodate those programs like PeachText which ignore the path command; they can only read and write to the directory that was active prior to their execution.

While you are in Z-BASIC, a SAVE command will store your current program in a file on the current drive, unless you specify some other drive in the SAVE command.

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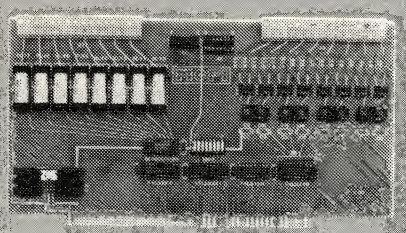

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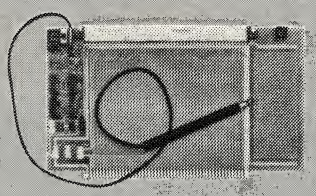

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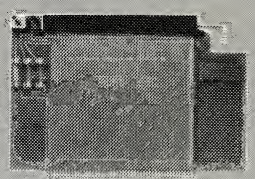

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Version 1.2 includes a dumb "no-eyestrain" 80 by 25 character mode, for logging-on and other activities where Tek mode not needed. Z-100 version provides extensions for color (NOT 41xx compatible), such as automatic different color for text versus graphics. Comprehensive concise manual gets you started quickly. Requires ZDOS/MSDOS/PCDOS 1.1 or above. $129.95

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TIMEKEEPER can be configured for use in a Business Office, Law Office, Medical Clinic, Courtroom, Probation Dept., Social Services Agency, or for Client Tracking. **TIMEKEEPER** is a multi-dimensional time management system that will quickly perform the following tasks:

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Send messages by placing messages in any person's file.

See a graphic display of any person's daily activity.

Replicate messages, appointments, classes, or other regularly scheduled events on a daily, weekly, monthly or yearly basis. **TIMEKEEPER** will skip weekends when replicating, if desired.

Scan entries in their entirety or by user specified criteria beginning on any date chosen. This is ideal for time utilization reporting and analysis.

Keep track of conference room, facilities, and equipment usage.

Controls calendars for any month in this century.

Create a "Coming Attractions" notation for certain messages, meetings, and events that you wish to be reminded of in advance.

Send all reports to the screen or printer.

TIMEKEEPER is fully menu driven for ease of use and provides extensive on-line help for the entire system. **ONLY $ 99.00**

Program Requirements: **(Indicate Standard MS-DOS or IBM-PC on order)**

Standard MS-DOS 2.0 (or higher) version: Any system compatible with dBASE II (TIMEKEEPER is in compiled form, dBASE II is not required), at least a dual floppy system (Winchester hard disk is recommended), at least 128k free memory after loading MS-DOS, printer optional but recommended.

IBM-PC version: requires 100% IBM-PC compatibility, monochrome or color. Works on Zenith Z-150. Tailored for IBM-PC so it runs slightly faster than the standard MS-DOS version.

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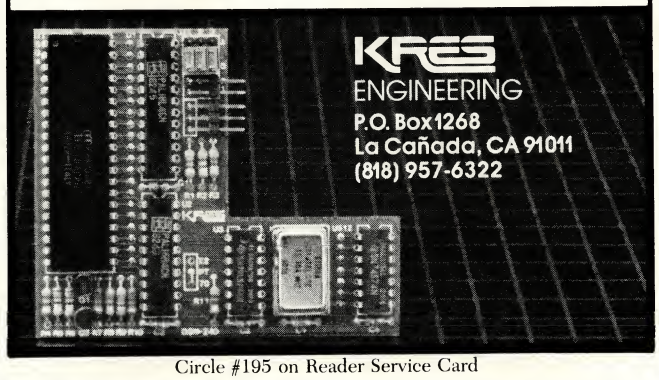

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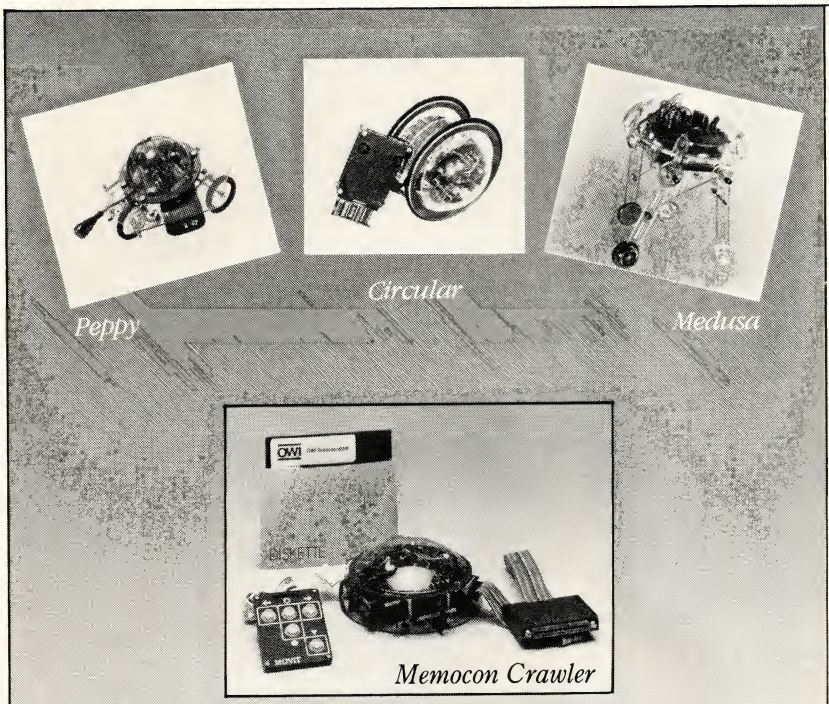

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Circle #184 on Reader Service Card

Date Your HDOS Printouts Automatically

GETDATE lets you take the date from HDOS and include it in any listing created by TEXT.

Jonathan Booth

My H89 gets quite a lot of use as a word processor. I have just published a book that was written, edited, and typeset on it. For word processing, I use The Software Toolworks' PIE editor and TEXT text-formatter programs, running under the Heath Disk Operating System (HDOS). (PIE and TEXT have been well described elsewhere. See "A Professional Writer Looks at Budget Word Processing" by Hugh Kenner, in *Sextant* #1, Spring 1982.)

Quite frequently during the writing of the book, I would print out a draft of a section with the current date at the beginning of the section, or at the top of each page. Then, a few days or a week later, I would print the section again with revisions—only to discover that I had forgotten to change the date in the file.

After a little time has passed, it is not always easy to see which one is the later revision. When developing programs, a similar situation occurred—I would end up with two revisions—which at first glance looked the same, but which were from different days.

I realized that HDOS always asked me for the date during boot-up; so I decided to write a program that would get the date for me and put it in a disk file. TEXT could then get that information whenever I was printing a file.

Getting the date and storing it is the function of the GETDATE program. (See Listing 1.) I keep GETDATE on the boot disk under the name PROLOGUE.SYS; so HDOS runs it automatically after boot-up, with no attention required.

Now, with a couple of simple TEXT instructions in a file, I can have the current date printed wherever I want in a document—and with very little effort.

TEXT features used

TEXT has two features which my program takes advantage of.

One feature is the "readfile" instruction. This allows another disk file to be included in the printing of a file. It is an instruction which appears on its own line in the form:

```
.rf filename
```

The other is a string-substitution (.sb) feature. This instruction allows an "abbreviation" for a character string to be placed anywhere in the text. Up to 26 substitutions (indicated by lowercase a–z) can be defined with instructions such as:

```
.sb d 21-Dec-83
```

The full string (in this case, the date) will then be printed anywhere in the text by using an in-line instruction such as \sd. (Here, the letter "d" for the substitution was chosen to stand for "date." It could be changed to any other letter.)

Reading the DATE file

As it's given in Listing 1, the GETDATE program creates a disk file called simply "DATE". (You might want to add a drive specification or extension.) DATE contains just one line: a string-substitution instruction in the form:

```
.sb d dd-mmm-yy
```

where dd-mmm-yy will be the date.

The current date will be printed wherever the command \sd occurs in the text.

To use the date in your text file, it is first necessary to include a "readfile" instruction to get the date-substitution string and place it in the file to be printed.

Since that string will be in the file called "DATE", the necessary instruction is simply:

```
.rf date
```

Once that file has been read by TEXT, the current date will be printed wherever the command \sd occurs in the text. (The readfile instruction must occur before the first use of the \sd; or else TEXT will print an error message, and stop processing, when it comes to the undefined \sd.)

So the beginning of a text file might be set up like this:

```
.in 7
.rm 70
.nj
.rf date
.he "Book Draft"\sd"Page \#"
```

The first two lines above set the margins; .nj (no-justify) indicates a ragged right margin. The fourth line reads in the file that contains the date-substitution string. The last line causes TEXT to put a header at the top of each page: with "Book Draft" on the left, the current date in the middle, and the page number on the right.

HDOS date location

The GETDATE program makes use of the fact that HDOS gets the current date from the user during boot-up (as long as the NODATE option has not been set). HDOS stores the date in a specific location in memory. The date is stored in the nine bytes starting at 8383 decimal (or 040 277 in split octal). It is stored in the form dd-mmm-yy; for example 21-Dec-83 or 06-Jun-83. If the NODATE option has been set, that location contains "No-Date".

How the program works

The GETDATE program itself is simple and straightforward. All it has to do is get nine bytes from memory and put them, together with the substitution instruction, in a file called DATE.

At the top of the listing, the actual program does not start at the normal starting location (USERFWA, for USer First Word Address). Instead, the program starts 260 bytes *above* USERFWA. This gives a convenient space for a 256-byte file buffer. We only need to write 16 bytes, but HDOS requires that all writing to files be in 256-byte amounts.

The program starts with the CLEAR routine, filling the 256-byte file buffer with nulls.

The GETSUB routine puts the first part of the TEXT substitution instruction (".sb d" followed by one space) into the beginning of the file buffer.

The MOVDATE routine gets the date from where HDOS stores it, and moves

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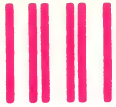

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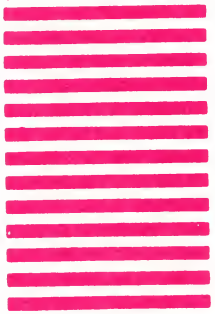

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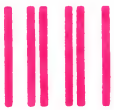

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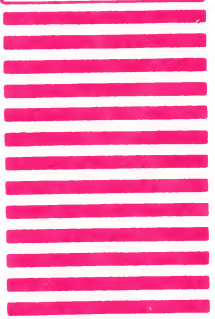

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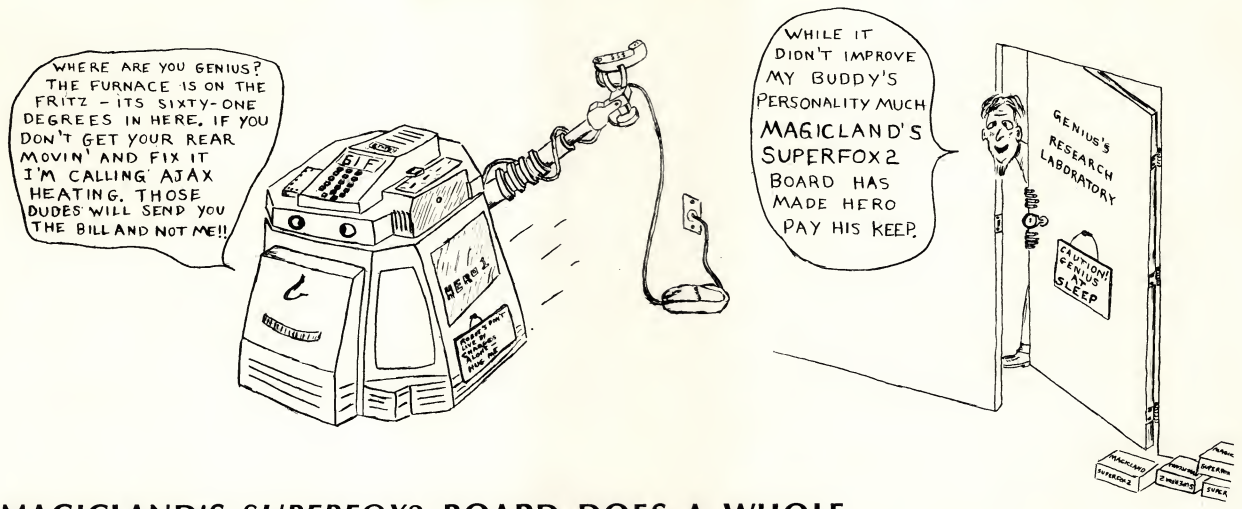
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it into the file buffer to complete the substitution instruction. It ends with the HDOS new-line character.

The format of the date could be changed in the MOVDATE routine; for example, by not transferring the first byte if it is a "0" (to remove leading zeroes, as in 03-Dec-83). Another possibility would be to change the two hyphens to spaces.

OPEN uses an HDOS .SCALL to open the file DATE on SY0:. The WRITE routine writes the buffer into the file. And then CLOSE closes the file. If an error occurs during any of those three routines, the program jumps down to BADEXIT to print an error message and exit to HDOS.

Using the program

The program can be assembled with the HDOS assembler program "ASM". It makes use of two .ACM files: HOSDEF and HOSEQU, which must be on-line during assembly.

Once the GETDATE program is assembled without errors, simply transfer it to the boot disk and give it the name "PROLOGUE.SYS". From now on, the program will run automatically after boot-up. (If you have another PROLOGUE.SYS program that you still want to use, the EXIT routine can be changed to perform a LINK to your prologue program. The older prologue will then have to be renamed.)

The assembled GETDATE program takes up only one disk sector. And if the "S" flag is set using the HDOS flags program, it can be virtually invisible to the user.

All in all, this is a simple program which I have found to be very useful.

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```
*       GETDATE PROGRAM
*       Written by Jonathan Booth
*
        XTEXT   SY1:HOSDEF      ; These two files must be on-line
        XTEXT   SY1:HOSEQU      ; for assembly

        ORG     USERFWA+260     ; leave 260 bytes for buffer
MEMDATE EQU     8383            ; location of date in memory
NL      EQU     10              ; HDOS newline character

DATEBUF EQU     USERFWA         ; 260-byte file buffer
SUB     DB      '.sb d ',0      ; substitution command for TEXT program

GETDATE EQU     *               ; start of program

CLEAR   LXI     H,DATEBUF       ; get buffer address
        MVI     B,0             ; we will clear 256 bytes in buffer
CLRLOOP MVI     M,0             ; clear one byte in buffer
        INX     H               ; increment buffer pointer
        DCR     B               ; count down from 256
        JNZ     CLRLOOP

GETSUB  LXI     H,DATEBUF       ; set HL to start of buffer again
        LXI     D,SUB           ; DE points to substitution string
SUBLOOP LDAX    D               ; get one byte
        ORA     A               ; (null byte signals end of string)
        JZ      MOVDATE
        MOV     M,A             ; put next byte in buffer
        INX     H               ; increment buffer pointer
        INX     D               ; and substitution string pointer
        JMP     SUBLOOP

MOVDATE LXI     D,MEMDATE       ; set DE to start of date in memory
        MVI     B,9             ; date is nine characters long (DD-MMM-YY)
MOVLOOP LDAX    D               ; A=next character of date
        MOV     M,A             ; put in buffer
        INX     H               ; increment buffer pointer
        INX     D               ; and date pointer
        DCR     B               ; until 9 characters moved
        JNZ     MOVLOOP
        MVI     M,NL            ; end with a newline character

OPEN    LXI     D,DEFAULT       ; default drive is 'SY0:'
        LXI     H,FNAME         ; 'DATE' is the file name
        MVI     A,1             ; use channel number one
        SCALL   .OPENW
        JC      BADEXIT         ; check for error in opening file

WRITE   MVI     A,1             ; set up HDOS write call
        LXI     B,256           ; buffer is 256 bytes (one sector)
        LXI     D,DATEBUF       ;
        SCALL   .WRITE          ; tell HDOS to write it
        JC      BADEXIT         ; check for error

CLOSE   MVI     A,1             ; close up file (channel 1)
        SCALL   .CLOSE          ;
        JC      BADEXIT         ; check for error

EXIT    XRA     A               ; all done, use normal exit
        SCALL   .EXIT           ; call HDOS exit

DEFAULT DB      'SY0',0,0,0     ; file name and default
FNAME   DB      'DATE',0        ; "SY0:DATE"

BADEXIT LXI     H,ERRMESS       ; error in writing file ends up here
MESLOOP MOV     A,M             ; get one character in error message
        ORA     A               ; null character marks end of message
        JZ      EXIT            ;
        SCALL   .SCOUT          ; output one character
        INX     H               ; increment string pointer
        JMP     MESLOOP         ; and go for another character

ERRMESS DB      7,'Error writing date file.',NL,0
        END     GETDATE
```

Listing 1. GETDATE.ASM. Used in combination with the TEXT print formatter, GETDATE enables the current HDOS date to be included in printouts. Note that the XTEXT references at the beginning require a drive specification if the files are not on the same disk as ASM.

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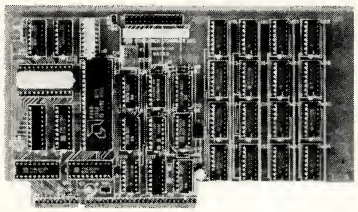

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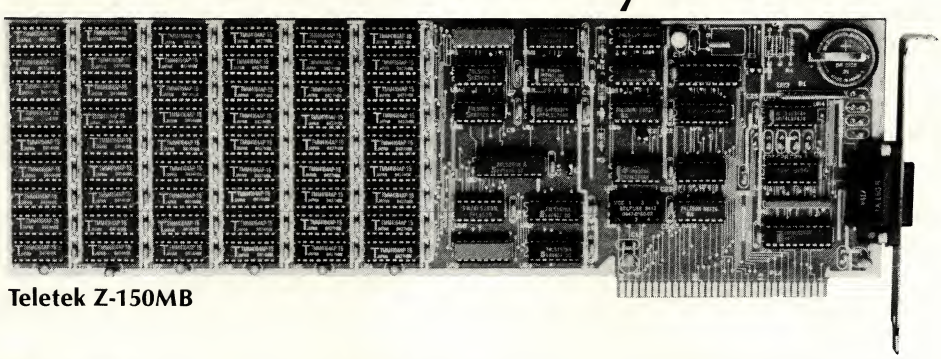

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A Critical Look at the 8088

The central processor for the Z100 and Z150—how does it stack up? A lot better with a math chip, even for non-math functions.

Rick Lutowski

The central-processor unit (CPU) is the heart of a computer. Frequently, it is also the heart of controversies surrounding a given computer. Speed, power, compatibility, and ease of programming are all at stake in the choice of a CPU.

Perhaps there will some day exist a CPU that will give us all these things without compromise. But in the meantime, most chips seem to impose some sort of sacrifice for the benefits they promise. If a computer's CPU gives you X, you probably have to give up Y in order to get it.

The Intel 8088 CPU, the brain of the H/Z100 and '150 series computers, is no exception.

It is generally believed that the 8088 offers improved performance over older CPUs—such as Intel's 8080 used in the H8, and its improved cousin, Zilog's Z80 used in the H/Z89 and as an option for the '8. Intel claims that "the [5-MHz] 8088 is from four to six times more powerful than the [2-MHz] 8080A."

How valid are such claims?

Usually, CPUs are compared at the level of primitive machine (or assembly-language) instructions. Technicians will test individual instructions, noting differences in the various CPUs' clock rates, instruction cycle times, etc.

Such analyses, however, bear little resemblance to the environments in which the processors are actually used—the world of high-level languages. Language compilers and interpreters generate code in ways that are very non-optimum compared to the assembly-language environment of the manufacturer's laboratory, where data that will eventually be used in advertising is often measured.

Outside of Intel's labs, then, does the 8088 live up to its advertising claims? To answer this, I compiled an extensive set of FORTRAN benchmarks. The results offer some interesting insights.

Before going into these results, however, we should first familiarize ourselves with some relevant design aspects of the 8088.

Primary design goals of the 8088

Two primary goals apparently drove the design of the 8088. They were the desire for software compatibility with the 8080, and a requirement to address more memory than the 8080.

Software compatibility with the 8080 was apparently a high-priority goal because of the effect it could have on sales of the new CPU. Over time, a large body of software had become available for the 8080. The new chip would have a built-in advantage if it could have some sort of compatibility with the old software.

The same software base that was responsible for the compatibility requirement was also the driving force behind the need for a larger memory address space. As more applications were developed for the 8080, the sophistication of the programs began to increase. More sophisticated applications in turn made greater demands on the CPU. In particular, many applications, such as spreadsheets and data base managers, were becoming more memory intensive; they began bumping up against the limits of the 8080's relatively limited, 64-kilobyte address space.

Unfortunately, as we shall see, the objectives of software compatibility and increased address space tend to oppose each other. Intel solved the inherent conflicts by settling on a design compromise. This compromise profoundly affected not only the design of the 8088 but, indeed, their entire line of new CPUs. Users of Intel CPU products will have to live with the results of this design compromise for at least the remainder of the 1980s.

Let us now explore the issues surrounding this design compromise—the form it took, and the technical rationale behind it. This will not only give us a better understanding of how our 8088-based machines tick, but will help explain the benchmark results that will be presented later.

Compatibility—what level?

In achieving the software-compatibility goal, Intel first had to determine at which level the compatibility was to occur. Two computers can be software compatible at three levels.

(1) They can be compatible at the executable-binary (run-file) level. If so, then a program which can run on its own on one machine, will be able to run just as well on the other.

(2) They can be compatible at the assembly-language level. If so, then the same assembly-language program can be assembled and run on either machine.

Or (3) they can be compatible at the source-code level of standard languages such as FORTRAN or COBOL. Theoretically, of course, a program written in a standard language should be able to run on any machine that supports the language. That's one of the *purposes* of a high-level language. Usually, however, the developers of a given language on a given machine throw in their own unique features—compromising compatibility in the process. That is the result of software decisions, though. It is not usually dictated by the CPU chip.

Generally, the lower the level of compatibility—i.e., the closer to the binary level—the more quickly software can be converted from one system to the other. If compatibility is a design goal, then it is desirable to have it occur at the lowest level possible.

The level at which software compatibility is achieved depends primarily on the similarity in instruction sets between the two computers. *Binary* compatibility requires that each machine use exactly the same binary machine codes.

In the case of the 8080, each binary instruction was one byte (8 bits) long, resulting in a maximum of 256 (2^8) binary instructions. The 8080 used 244 of these 256 possible instructions. The 12 unused instruction bit patterns were an insufficient base upon which to build a new, higher-power CPU.

Indeed, Intel had already built a new CPU that achieved 8080-compatibility. Simply using some of the 12 unused 8080 instruction patterns allowed them to produce the 8085—the Z100's co-processor that lets us run older software.

But the 8085 was not the answer to the needs of the evolving software industry. The binary instruction patterns

of the new CPU clearly would have to be two bytes (16 bits) long. Or, at least, they would have to consist of combinations of one- and two-byte instruction codes.

Perhaps the new CPU could use the same old 8080 one-byte instructions and, in addition, could support an extended set of two-byte machine-instruction codes. This, however, is an exact description of the Z80 instruction set, and the Z80 is barely more adequate than the 8080. Also, the goal of addressing more than 64K could not be achieved by an expanded set of two-byte instruction codes.

Due to reasoning such as this, binary compatibility, although desirable, was not considered feasible.

Unlike *binary* compatibility, however, *assembly-language* compatibility does not require that two CPUs use the same binary machine instructions. Rather, only the *assembly languages* for the two machines need be compatible. An assembler translates the assembly-language program to the corresponding binary machine instructions. So the assemblers for the different machines will take care of differences in the binary instruction sets.

In order for two assembly languages to be compatible, two CPUs must share a common hardware architecture and a common set of operations. From a programming standpoint, "hardware architecture" mainly refers to two things. First, it refers to the number and types of registers—a CPU's on-chip, high-speed storage devices. Second, it refers to the method of input/output (I/O)—either port I/O or memory-mapped I/O.

Thus, assembly compatibility required only that the 8088: (1) have a set of registers that mapped one-for-one to the 8080 registers; (2) use 8080-type port I/O; and (3) be able to perform all the same operations (such as adding, branching, etc.) as the 8080.

This was much less restrictive on the design than binary compatibility. Desired additional capability could be achieved by adding new registers and I/O ports to the 8080 hardware architecture, and new operations (such as multiply and divide) to the instruction set. Assembly-level compatibility thus permitted significant increases in capability while still maintaining a degree of software compatibility. This was the approach chosen for the 8088.

The immediate consequence of such a choice was that software developers could reassemble 8080 programs to run on the 8088. And developers would do just that. Most programs might contain machine-specific code which would have to be altered. And some programming would be required to translate 8080 instructions into their 8088 counterparts. But these would be relatively straightforward tasks. The 8088 could be "born" with a body of software ready to run on it.

Architecture—a matter of registers

With assembly-language compatibility selected, there was still the question of how to achieve an increase in memory address space. Intel's solution to this problem probably had a more profound impact on the design of the 8088 than any other design decision.

In order to facilitate understanding Intel's solution to this problem, however, we must first learn more about registers.

A CPU's registers are grouped into classes based on their function. Some registers are designed to hold data values, such as the operands in an arithmetic operation; these are called "general-purpose" or "data" registers.

Another class of registers are designed to control the operation of a program. These registers, such as the 8080 program counter and stack pointer, usually contain values referencing memory locations—memory-address pointer values. Hence, they are sometimes called "pointer" registers.

Large computers that can handle many users at once have another group of registers, called "memory-management" registers. These registers are used for controlling the allocation of memory and other computer resources among the different users.

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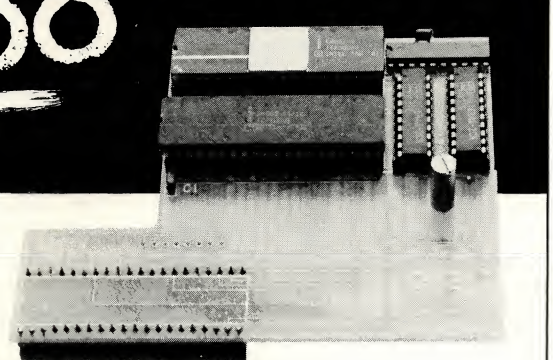

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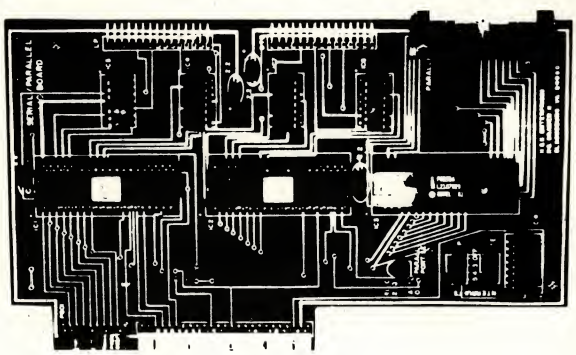

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The classes of registers, the number of registers in each class, and the size of the registers are what make one computer's architecture different from another's.

Address space, the *number of memory locations* which can be addressed by a CPU, is strictly a function of the size of the *pointer* registers. A CPU with n-bit-wide pointer registers has an addressable-memory size of 2^n memory locations. The *size* of a memory location, however, tends to be related to the size of the *general-purpose*, or *data*, registers.

Much confusing computer terminology has its roots in the sizes of the different types of registers. For example, the 8080 and Z80 are known as "8-bit" CPUs. This is despite the fact that their pointer group is 16 bits wide—which gives them a memory address space of 2^16, or 65,536 (64K) memory locations. But each of these memory locations is 8 bits wide—because the general-purpose registers, which accept data to and from memory, are 8 bits wide. This is why the Z80 and 8080 are called 8-bit CPUs.

By contrast, the Motorola 68000 has 16-bit general-purpose registers (organized in 32-bit pairs) and 32-bit pointer registers. Due to the complex way in which address calculations are performed, only 23-bit addresses can be formed, giving the 68000 an address space of 2^23, or more than eight million, memory locations. Each of these memory locations is 16 bits wide; which matches both the binary instruction size and the basic size of the general-purpose registers.

Consequently, the 68000 was at first referred to as a 16-bit CPU. Due largely to marketing competition brought on by the introduction of National Semiconductor's 16032 CPU, however, Motorola is now referring to the 68000 as a 32-bit CPU—based on the apparent width of the paired general-purpose register groups. (Thus, what a CPU is called is often determined as much by the manufacturer's *marketing* group as by the *register* groups. In fact, National's 16032 has been re-named: now it's the 32016. And the 16000-series chips of which it's a part are now called the 32000 series.)

With the above as background, we can now explain Intel's solution for obtaining increased address space.

Segmentation—the big compromise

For the new CPU to be assembly-compatible with the 8080, it needed to have a similar register configuration. In particular, the pointer-register group remained 16 bits wide.

Keeping the 16-bit pointer registers meant that the 8088 would be able to address only 64K, just like the 8080. And keeping the 16-bit pointer registers is why the goals of software compatibility and extended addressing resulted in an inherent design conflict.

For a solution to this dilemma, Intel turned to architectures used on large mainframe computers.

As mentioned earlier, large mainframes usually incorporate a memory-management group of registers to control simultaneous usage of the CPU by multiple users. Intel's solution consisted of adding a new group of registers which, in some respects, resembled memory-management registers. They did not arbitrate between multiple *users*, however. Instead, these registers were designed to control the allocation of multiple 64K *memory segments* to a single user or program. Thus, they were called "segment" registers.

The segment group consisted of four 16-bit registers—a code-segment (CS) register, a stack-segment (SS) register, and two data-segment registers (DS and ES). Like the pointer registers, the segment registers would contain memory-address pointer values.

The CS register would point to the 64K memory block containing the binary instruction code of the program currently being executed. The SS register would designate another 64K memory block; this memory block would be used as the stack, serving as a temporary buffer holding values passed from one part of a program to another. The DS and ES registers would each point to a 64K block of memory containing the data values referenced by the program in the code block. Using this approach, the new CPU could use four indepen-

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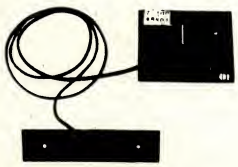

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dent 64K blocks, or 256K, of memory at once.

With the 8088, an address in physical memory is determined by combining a 16-bit value in one of the pointer or general-purpose registers (Register Address) with another 16-bit value in a segment register (Segment Address) according to the following formula:
Physical Address = (16 x Segment Address) + Register Address

Multiplying a 16-bit segment value by 16 (2^4) gives a 20-bit result, so the physical address space of the 8088 incorporates 2^20, or 1,048,576, memory locations. Because the 8088's general-purpose registers mirror those of the 8080, each memory location is one byte. So the result is a one-megabyte (1 MB) address space.

Because there are four segment registers, only four 64K blocks within the 1 MB space may be referenced at once. However, it was felt that this was a significant improvement over the simple 64K address space of the 8080 and Z80. (In theory, they could have gotten more than those four blocks by adding still more segment registers. But you can only pack so much into a chip and still produce it economically.)

Programming possibilities

This segmented memory structure of the 8088 gives a programmer some rather interesting options when developing a program. In the simplest case, you can simply load all the segment registers with the same value, so they all point to the same 64K memory block. Then you can program the 8088 as if it were an enhanced 64K 8080. This is called the 8080 programming model, sometimes also the "small-segment" model.

Perhaps the most common way of utilizing the segment registers is to load the CS register with one value, and the SS, DS, and ES registers with a second value. This places all the program code in one 64K memory segment, and all the program data, including the stack, in a second 64K memory segment. This, too, is often referred to as the "small-segment" programming model.

Another obvious choice is to load each segment register with a different memory pointer value. This permits a program to use 64K for code, another 64K for a stack, and 128K (in two separate 64K blocks) for data.

A more powerful and complex option is to have the program change the segment register values periodically during execution. For example, a program may be designed to load a new value into the CS register each time a subroutine is called. This permits each subroutine to be up to 64K, and total code size can be many 64K memory segments in length.

Similarly, the DS or ES registers can be changed each time a new array is referenced. This permits individual arrays to occupy up to 64K, and total program data sizes to be many 64K blocks long. This approach, which is used by many of the newer high-level language compilers, is called the "large-segment" programming model.

The most challenging option is to rigorously treat the segment registers as extensions to the pointer and general-purpose registers. Each pointer and general-purpose register is then effectively 20 bits long. (See the physical-address formula above.) You thereby permit the code, stack, and data portions of the program to utilize any or all of the 1-MB physical address space.

This approach entails changing registers in pairs. A pointer-register change triggers a segment-register change; you must also update a segment register each time a general-purpose register changes (when the general-purpose register is being used to reference memory).

This approach is the most powerful insofar as memory utilization is concerned. However, it entails an inordinate amount of register bookkeeping. To the best of my knowledge, it has not been used, and remains simply a theoretical possibility.

In any event, the twin solutions of segment registers and assembly-level compatibility were considered acceptable for achieving extended addressing while maintaining some degree of 8080 software compatibility. In the process,

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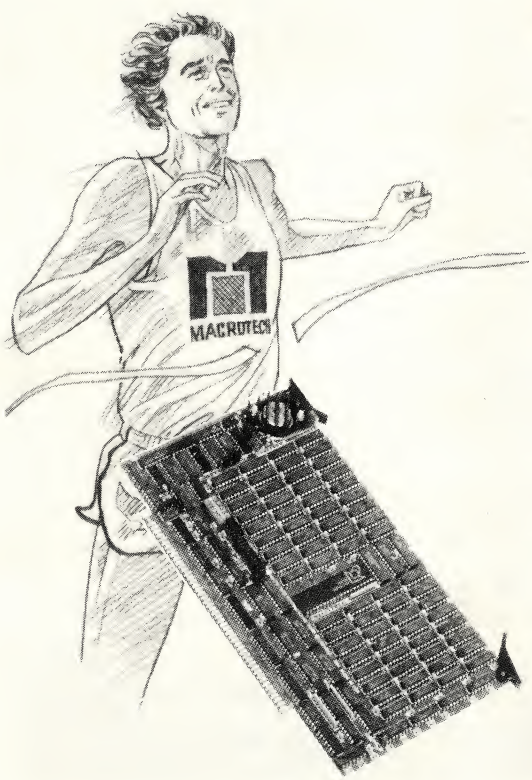

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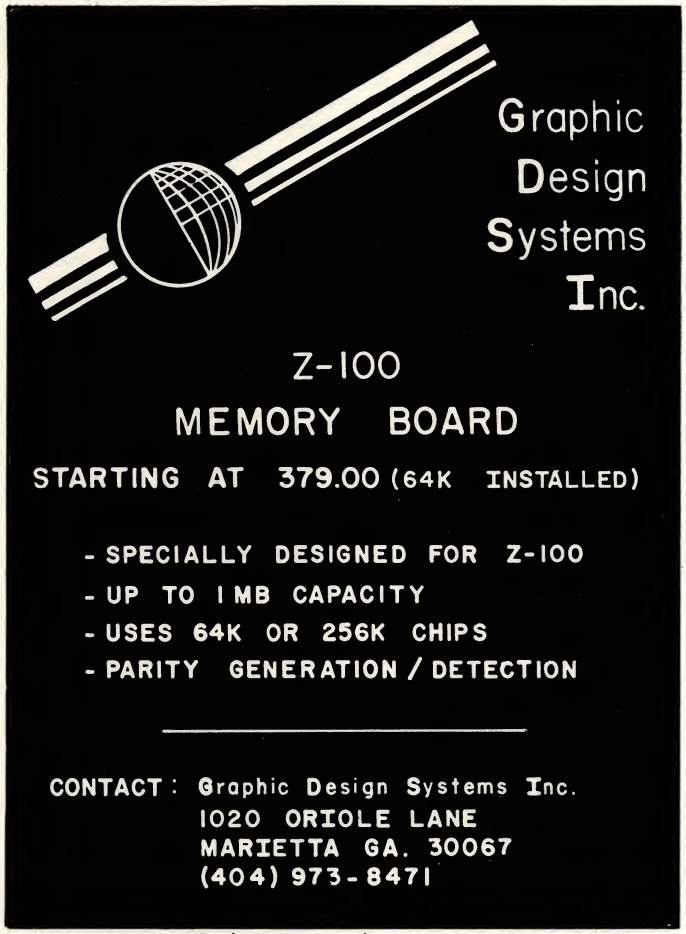

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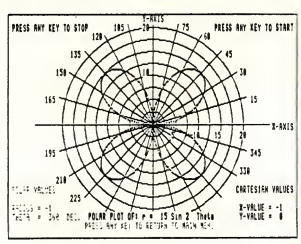

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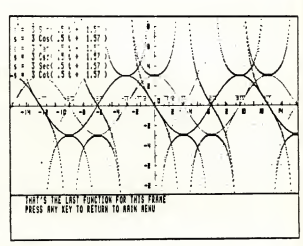

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8088 Design Goal	Code Size	Run Time	Physical Address Space	Level at Which Existing Programs Can Be Adapted
Upward Compatibility				•
Extended Addressing			•	
Better Performance		•		
Easier Programming	•			
Better Software Design	•			

Figure 1. Measures of merit selected in order to evaluate the 8088's success in meeting its design goals.

some novel programming possibilities were created.

Secondary design goals of the 8088

In addition to the goals of 8080 code compatibility and extended addressing, another objective was to improve the 8080 instruction set. As already noted, the decision to support assembly-level software compatibility permitted instruction-set improvements.

The desire for such improvements therefore reinforced the rationale for assembly-level software compatibility, rather than binary compatibility. Instruction-set improvements were intended to make the new CPU both more powerful and easier to program—qualities which would be appreciated by the developers of future applications software.

So the 8088 incorporated a number of features lacking in the 8080. Some of these improvements were:
(1) the addition of *multiply* and *divide* instructions;
(2) more powerful methods of addressing memory and the stack;
(3) more I/O ports and somewhat improved I/O instructions;
(4) string-manipulation instructions;
(5) improved logical and bit-shift instructions;
(6) the ability to perform most operations in any register, rather than only in the accumulator (the 8080's "A" register); and
(7) elimination of the 8080's conditional call instructions; and restriction of conditional jumps to a range of 127 bytes.

This last item is somewhat strange in that it entails a *reduction* in capability compared to the 8080. However, it reflects another design goal of the 8088, i.e., to enforce good coding practices via the machine architecture.

Good coding practice was assumed to be represented by certain techniques advocated by modern computer-science theory. These included modular program structure, recursive/re-entrant code, and structured code. The restriction on conditional branching was intended to help avoid "spaghetti" code and promote structured coding.

Other architectural deferences to modern computer-science theory included the inclusion of a base-pointer (BP) register for referencing parameters passed on the stack. Passing parameters on the stack promotes recursive and re-entrant code. Recursiveness is the ability of a subroutine to call itself. Re-entrancy is the ability of a subroutine or program to be used simultaneously by more than one user (in a multi-user environment) or more than one task (in a multi-tasking environment).

The segment registers, and the entire concept of segmentation, were also regarded as a positive contribution to good code design. According to Intel's literature, "The segmented structure of the 8086/8088 memory space supports modular software design by discouraging huge, monolithic programs."

Since the 8088 was designed, Intel's romance with computer-science theory has become something of a marriage; the iAPX 432 CPU chip set is its first-born child. The 432 is the first hardware in the world designed from the ground up to run Ada, the new Department of Defense language which reflects modern computer-science thought. Unfortunately, the 432 is apparently experiencing major teething problems, which could result in its premature death.

It remains to be seen if such an event would cause Intel to divorce itself from computer science *à la* silicon. Regardless, the 8088 architecture reflects the early stages of a courtship between CPU design and computer-science theory.

So these were the design goals of the 8088: software compatibility, extended addressing, better performance, easier programming, and promotion of better software design. How well does the 8088 meet these goals?

Measures of merit

To answer that question, some measures of merit are required. Ideally, a measure of merit should be quantitative: i.e., it should be possible to determine numerical values for parameters that relate to the 8088's performance, addressing, ease of programming, etc.

To this end, I selected the following four measures of merit: (1) execution time; (2) code size; (3) physical address space; and (4) the level of the software-development process (binary, assembly, or high-level). Figure 1 shows which measures of merit relate to each of the design goals being evaluated.

FORTRAN benchmarks

In order to determine quantitative values for the measures of merit for execution time and code size, I developed six simple FORTRAN benchmark programs; each program emphasized a particular type of operation. This allowed a detailed evaluation of CPU performance for each of the types of operations. The six benchmarks are divided into two major classes: non-math and math. The six benchmarks, by class, are:
(A) Non-math operations
(1) Subroutine-calling and param-

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```
C       FORTRAN BENCHMARK #1: SUBROUTINE CALL
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 1
C                       INITIALIZE ARGUMENTS
        J = 0
        K = 0
        A = 0.
        B = 0.
        C = 0.
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 100 I=1,10000
C                       CALL SUBROUTINE WITH MIXED ARGUMENTS
        CALL SUB (I,A,J,B,K,C)
  100   CONTINUE
C                       DONE
        STOP
        END
C
C       SUBROUTINE WITH MIXED ARGUMENTS
C
        SUBROUTINE SUB (I,A,J,B,K,C)
C                       RETRIEVE ARGUMENT VALUES
C                       TO TIME ARGUMENT ACCESS EFFICIENCY
        J = J
        K = K
        A = A
        B = B
        C = C
        RETURN
        END
```

Listing 1a. Source code for the FORTRAN benchmark for subroutine calling.

```
C       FORTRAN BENCHMARK #2: BRANCHING/ASSIGNMENT
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 2
C                       INITIALIZE VARIABLE FOR REAL ASSIGNMENT
        X = 0.
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 200 I=1,10000
C                       LOOP FOR EACH OF THREE BRANCHING STATEMENTS.
C                       PERFORM 2 INTEGER COMPARISONS TO ONE REAL
C                       TO MORE CLOSELY REFLECT REAL PROGRAMS
        DO 100 J=1,3
C                       BRANCH TO BRANCH STATEMENT
        GOTO (10,20,30), J
C
C                       BRANCH #1 (INTEGER)
   10   IF (I) 300,300,11
C                       ASSIGNMENT #1 (INTEGER)
   11   K = I
        GOTO 100
C
C                       BRANCH #2 (INTEGER)
   20   IF (J) 200,200,21
C                       ASSIGNMENT #2 (INTEGER)
   21   L = J
        GOTO 100
C
C                       BRANCH #3 (REAL)
   30   IF (I-J) 100,100,31
C                       ASSIGNMENT #3 (REAL)
   31   Y = X
C                       REPEAT LOOPS
  100   CONTINUE
  200   CONTINUE
C                       DONE
  300   STOP
        END
```

Listing 1b. Source code for the FORTRAN benchmark for branching/assignment.

eter-passing

(2) Branching and assignment

(3) Conversion of numeric format from integer to real-number

(B) Math operations

(4) Integer arithmetic (add, subtract, multiply, and divide)

(5) Real arithmetic (add, subtract, multiply, and divide)

(6) Real functions (trigonometric and exponential)

In addition, composite performance was measured using a FORTRAN "whetstone" benchmark. A whetstone benchmark is a widely used public-domain program for measuring FORTRAN performance on different systems. It contains code for all of the six operations addressed by the individual benchmarks described above. The developers of the program invested considerable effort to ensure that the mix of operations in the whetstone was representative of the operation mix in a typical FORTRAN program.

Source code for each of the six operation-specific benchmarks is given in Listings 1a to 1f. Source for the whetstone benchmark is shown in Listing 1g.

The benchmarks were used to measure the performance of the following hardware/software system combinations:

(1) 2-megahertz H8, with a Trionyx Z80 CPU board; running the Heath Disk Operating System (HDOS); and HDOS FORTRAN (Microsoft FORTRAN-80);

(2) 2-MHz H8 with a Trionyx Z80 CPU, and an Advanced Micro Devices AM9511 math chip; and HDOS (Microsoft) FORTRAN;

(3) 5-MHz Z110 (8088 CPU); running the Zenith Disk Operating System (Z-DOS); and IBM-PC FORTRAN, which is Version 1.0 of Microsoft's FORTRAN-86. (This FORTRAN has the strange property of generating large-segment code—but nonetheless restricting itself to 64K of code and 64K of data.)

(4) 5-MHz Z110 (8088 CPU); with Z-DOS; and Supersoft FORTRAN-86, which uses the small-segment model. (It, too, is restricted to 64K code and 64K of data; but this is consistent with the definition of small-segment code.)

(5) 5-MHz Z110 (8088 CPU); with Z-DOS; and Zenith's FORTRAN-86, which is Version 3.0 of Microsoft's FORTRAN-86. (This is a significantly cleaned up and enhanced version of the 1.0 compiler. It uses large-segment code generation to actually reach across segment boundaries and achieve extended addressing capability.)

(6) 5-MHz IBM Personal Computer (8088 CPU), with 8087 math chip; running the IBM-PC Disk Operating System (PC-DOS); and Zenith's FORTRAN-86. This is equivalent to (5) with 8087 math-chip support added. (An IBM PC was used instead of a Z100

```
C       FORTRAN BENCHMARK #3: INTEGER TO REAL CONVERSION
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 3
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 100 I=1,10000
C                       CONVERT INTEGER TO REAL
        X = I
C                       REPEAT LOOP
  100   CONTINUE
C                       DONE
        STOP
        END
```

Listing 1c. Source code for the FORTRAN benchmark for conversion from integer format to real-number format.

```
C       FORTRAN BENCHMARK #4: INTEGER ARITHMETIC
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 4
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 100 I=1,10000
C                       ADDITION
        J = I+I
C                       SUBTRACTION
        J = J-I
C                       MULTIPLICATION
        J = I*3
C                       DIVISION
        J = J/I
C                       REPEAT LOOP
  100   CONTINUE
C                       DONE
        STOP
        END
```

Listing 1d. Source code for the FORTRAN benchmark for integer arithmetic.

```
C       FORTRAN BENCHMARK #5: REAL ARITHMETIC
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 5
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 100 I=1,10000
C                       USE LOOP INDEX AS SOURCE OF VARYING REAL VALUES
        X = I
C                       ADDITION
        Y = X+X
C                       SUBTRACTION
        Y = Y-X
C                       MULTIPLICATION
        Y = X*X
C                       DIVISION
        Y = Y/X
C                       REPEAT LOOP
  100   CONTINUE
C                       DONE
        STOP
        END
```

Listing 1e. Source code for the FORTRAN benchmark for real arithmetic.

because my Z110 did not have an 8087 chip.)

(7) 5-MHz Z110 (8088 CPU); with Z-DOS; and Digital Research FORTRAN-77, Version 1.0. (This is a relatively new, very flexible compiler from Digital Research which can be instructed to generate either large-segment or small-segment code. As discussed, large-segment code generation can utilize up to a full megabyte of memory, while small-segment code is restricted to 64K. The FORTRAN-77 benchmarks were run using both large- and small-

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```
        Microsoft                              IBM PC
        FORTRAN-80                           FORTRAN-86

;   MOVE ARGUMENT VALUE              ;   MOVE ARGUMENT VALUE (POINTER
;   (POINTER IN HL) TO DE            ;   ON STACK) TO DX
;                                    ;
                                         PUSH BP
                                         MOV  BP,SP
                                         LEA  SI,[BP+6]
                                         PUSH BX
                                         PUSH ES
                                         LES  BX,DWORD PTR [SI]
                                         LES  BX,DWORD PTR ES:[BX]
    MOV E,M
    INX H                                MOV  DX,[BX]
    MOV D,M
                                         POP  ES
                                         POP  BX
                                         POP  BP
```

Figure 2. Two methods of passing FORTRAN parameters: under HDOS FORTRAN-80 (on the left); and under IBM-PC FORTRAN (version 1 of Microsoft FORTRAN-86).

segment code options.)

(8) 5-MHz IBM PC (8088 CPU) with 8087 math chip; PC-DOS; and Digital Research FORTRAN-77. This is equivalent to (7) with 8087 math-chip support added.

Information on both execution time and compiled code size was gathered for each benchmark, as required to support the selected measures of merit.

The Z80 CPU without 9511 math support (#1, above) was chosen as the basis for comparing benchmark data. Any of the eight hardware/software combinations could have been chosen as the baseline for comparison. However, most of us are reasonably familiar with the performance of 2-MHz 8-bit systems like the H/Z89 and H8. So I felt a statement such as "the Z110's speed was twice that of the H8" would be more meaningful to the majority of us than the equivalent statement "the H8's speed was half that of the Z110's."

In order to make the results more comparable, the 2-MHz Z80 times were divided by two to approximate the results of running the Z80 at 4 MHz. (This could also have been achieved by using faster memory with the Trionyx CPU board.)

Experience with H8s and H/Z89s running at 4 MHz indicates that 4-MHz performance is actually slightly greater than twice the 2-MHz performance. This is probably because of the H8 and H/Z89 clock interrupts. These interrupts always occur at 2-millisecond intervals regardless of the CPU speed; they are less intrusive on performance at 4 MHz than at 2 MHz. As a result, the 4-MHz speed seems slightly faster than twice the 2-MHz speed.

Nevertheless, dividing 2-MHz results by two gives a good approximation of 4-MHz performance. (Under CP/M, the "divide by two" estimate should be exact, because the clock interrupts are disabled under CP/M.)

Size of compiled code under the 8088

Two of the 8088's design goals—easier programming and promotion of better software design—are closely related to code complexity. Less complex code is easier to write, and easier to read and maintain. Less complex code also tends to be smaller and less demanding of memory.

A compiler does automatically what a machine- or assembly-language programmer would do by hand; thus, compiled code *size* would seem to be a good barometer of machine-code *complexity*—which, in turn, reflects the "programmer-friendliness" of the CPU's instruction set.

The figures for measured code size for the six operation-specific benchmarks are shown in Table 1a.

The figures tabulated for code size do not include FORTRAN run-time library code. The contribution of the language library to program size is roughly constant for each language variant. Thus, the memory required by the language library was factored out of the code-size data, leaving only the code size of the benchmark programs themselves to be compared.

	Benchmark Type					
	Non-Math			Math		
Version of FORTRAN	Subroutine Calling	Branching	Number-format Conversion	Integer	Real	Functions
SuperSoft F86	157	144	45	82	95	124
Microsoft F80 (for the H8 and H/Z89)	227	195	62	93	120	162
Digital Research F77, small segment	296	209	76	104	156	187
Digital Research F77, large segment	370	220	87	115	167	216
Microsoft F86, version 3 (Zenith FORTRAN)	268	307	107	127	181	267
Microsoft F86, version 1 (IBM FORTRAN)	664	532	221	273	384	431

Table 1a. Measured code size, in bytes, produced by compilers for the six operation-specific benchmarks.

	Benchmark Type					
	Non-Math			Math		
Version of FORTRAN	Subroutine Calling	Branching	Number-format Conversion	Integer	Real	Functions
SuperSoft F86	0.7	0.7	0.7	0.9	0.8	0.8
Microsoft F80 (for the H8 and H/Z89)	1.0	1.0	1.0	1.0	1.0	1.0
Digital Research F77, small segment	1.3	1.1	1.2	1.1	1.3	1.2
Digital Research F77, large segment	1.6	1.1	1.4	1.2	1.4	1.3
Microsoft F86, version 3	1.2	1.6	1.7	1.4	1.5	1.6
Microsoft F86, version 1	2.9	2.7	3.6	2.9	3.2	2.7

Table 1b. Relative values of code size for the six benchmarks, "normalized" on the basis of an H8 with Z80 CPU, running Microsoft FORTRAN-80.

```
C       FORTRAN BENCHMARK #6: REAL FUNCTIONS
C
C       BY RICK LUTOWSKI   JULY,1983
C
C                       START WHEN USER PRESSES KEY
        PAUSE 6
C                       LOOP TO OBTAIN MEASURABLE TIME
        DO 100 I=1,1000
C                       USE LOOP INDEX AS SOURCE OF VARYING REAL VALUES
        X = I
        X = X/1100.
C                       TRIG FUNCTIONS
        T = SIN(X)/COS(X)
        Y = ATAN(T)
C                       EXPONENTIAL FUNCTION
        Y = T**X
C                       LOG FUNCTION
        Y = ALOG10(T)
C                       REPEAT LOOP
  100   CONTINUE
C                       DONE
        STOP
        END
```

Listing 1f. Source code for the FORTRAN benchmark for real functions.

Listing 1g. Source code for the standard FORTRAN whetstone benchmark.

```
C       Program WHET
C
C       Program to run standard whetstone benchmark test.
C
C       Output is in seconds per single pass through the benchmark,
C       and in whetstone instructions per second.
C
C       Program performs multiple passes through test, as determined
C       by user entered parameter "NPASS".
C
C       Subroutine POUT used during debugging runs to guarantee
C       correct program performance.  Calls to POUT should be
C       commented out once program has been debugged.
C
C       Machine dependencies:
C
C       Code should be transportable as is, with the following
C       possible problems:
C       1. Parameters "IN" and "IOUT", used in main program and
C          subroutine POUT, determine FORTRAN unit number for
C          input and output.  Data statements should be changed
C          to reflect host machine expectations.
C       2. FORMAT statements might need to be modified.
C       3. Timing routines BTIME and ETIME should be recoded to
C          utilize whatever timing capabilities are available
C          on host system.  Note that ETIME returns the number
C          of seconds (floating point) since the previous call
C          to BTIME.
C
C       ******************************************************************
        COMMON T,T1,T2,E(4),J,K,L
C
        DATA IN,IOUT /1,1/
C
C       ******************************************************************
        NPASS = 1
C
        WRITE (IOUT,1000)
 1000   FORMAT (25H WHETSTONE BENCHMARK TEST/)

 1001   WRITE (IOUT,1002) NPASS
 1002   FORMAT (8H NPASS (,I5,3H): )
C
        READ (IN,2000) NPASS
 2000   FORMAT (I5)
C
        IF (NPASS) 1001,1001,2001
C
 2001   AVER = 0.0
        DO 999 ITER=1,NPASS
C
```

→

For easier comparison, the code sizes for each benchmark were "non-dimensionalized" using the H8 results. In producing "H8-normalized" figures, I also accounted for the difference between the 4-MHz figures for the H8 and the 5-MHz speed of the Z100 and IBM-PC. The resulting "H8-normalized" figures are shown in Table 1b.

(A more refined benchmark process might try to isolate any possible discrepancies thrown in by differences among the hardware and software combinations; between Z-DOS and PC-DOS, for instance, and between the Z100 and the IBM PC. But I don't believe such differences would be significant enough to affect the overall validity of these tests.)

It is clear from Table 1b that:

(1) The IBM-PC FORTRAN large-segment compiler (version 1 of Microsoft FORTRAN-86) consistently generates code that is about three times larger than FORTRAN-80 code.

(2) Zenith's large-segment FORTRAN-86 (version 3 of Microsoft FORTRAN-86) generates code that is about 50% larger than FORTRAN-80 code.

(3) Digital Research's FORTRAN-77 in the large-segment mode generates code that uses 30% more memory than FORTRAN-80. When the small-segment code option is used, code size drops slightly to 20% more than FORTRAN-80.

(4) Supersoft's FORTRAN-86 generates code (small-segment) that is about 25% smaller than FORTRAN-80 code.

Thus, small-segment 8088 code appears roughly comparable in size to 8080 code (25% smaller in one case, and 20% larger in another case). However, large-segment 8088 code is substantially larger than 8080 code in all cases.

Why the greater size?

In an attempt to determine why large-segment 8088 code is larger than 8080 code, I compared some IBM-PC FORTRAN object code with the equivalent HDOS FORTRAN-80 code. Figure 2 illustrates the assembly-language code generated by the two compilers for a subroutine to which a parameter is passed via an argument list, as follows:

```
CALL SUB (A)
```

This example was selected because of its importance to high-level language applications. The object code generated by high-level language compilers consists largely of subroutine calls to the run-time library, similar to this example. Therefore, the efficiency with which parameters are passed in a call strongly influences the overall efficiency of the executable code produced by a high-level language.

Microsoft's FORTRAN-80 passes arguments as 16-bit memory pointers in the general-purpose registers. The subroutine code for retrieving the argument is shown in the left half of Figure 2.

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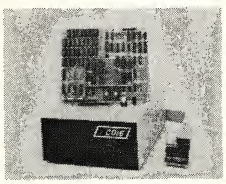

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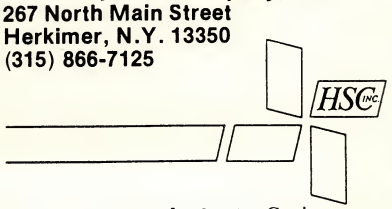

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```
C     ****************************************************************
C                          INITIALIZE VALUES
C
      T  = .499975
      T1 = .50025
      T2 = 2.0
      I  = 10
C
      N1 = 0
      N2 = 12*I
      N3 = 14*I
      N4 = 345*I
      N5 = 0
      N6 = 210*I
      N7 = 32*I
      N8 = 899*I
      N9 = 616*I
      N10 = 0
      N11 = 93*I
C
C     ****************************************************************
C                          START TIMER
C
      CALL BTIME
C
C     ****************************************************************
C                          MODULE 1: SIMPLE IDENTIFIERS
C
      X1 =  1.0
      X2 = -1.0
      X3 = -1.0
      X4 = -1.0
      IF (N1) 19,19,11
   11 DO 18 I=1,N1,1
         X1 =  (X1+X2+X3-X4)*T
         X2 =  (X1+X2-X3+X4)*T
         X3 =  (X1-X2+X3+X4)*T
         X4 = (-X1+X2+X3+X4)*T
   18 CONTINUE
   19 CONTINUE
      CALL POUT (N1,N1,N1,X1,X2,X3,X4)
C
C     ****************************************************************
C                          MODULE 2: ARRAY ELEMENTS
C
      E(1) =  1.0
      E(2) = -1.0
      E(3) = -1.0
      E(4) = -1.0
      IF (N2) 29,29,21
   21 DO 28 I=1,N2,1
         E(1) =  (E(1)+E(2)+E(3)-E(4))*T
         E(2) =  (E(1)+E(2)-E(3)+E(4))*T
         E(3) =  (E(1)-E(2)+E(3)+E(4))*T
         E(4) = (-E(1)+E(2)+E(3)+E(4))*T
   28 CONTINUE
   29 CONTINUE
      CALL POUT (N2,N3,N2,E(1),E(2),E(3),E(4))
C
C     ****************************************************************
C                          MODULE 3: ARRAY AS PARAMETERS
C
      IF (N3) 39,39,31
   31 DO 38 I=1,N3,1
      CALL PA(E)
   38 CONTINUE
   39 CONTINUE
      CALL POUT (N3,N2,N2,E(1),E(2),E(3),E(4))
C
C     ****************************************************************
C                          MODULE 4: CONDITIONAL JUMPS
C
      J = 1
      IF (N4) 49,49,41
   41 DO 48 I=1,N4,1
      IF (J-1) 43,42,43
   42 J = 2
      GOTO 44
   43 J = 3
   44 IF (J-2) 46,46,45
   45 J = 0
      GOTO 47
   46 J = 1
```

→

```
   47   IF (J-1) 411,412,412
  411   J = 1
        GOTO 48
  412   J = 0
   48   CONTINUE
   49   CONTINUE
        CALL POUT (N4,J,J,X1,X2,X3,X4)
C
C       ***************************************************************
C                       MODULE 5: OMITTED
C
C       ***************************************************************
C                       MODULE 6: INTEGER ARITHMETIC
C
        J = 1
        K = 2
        L = 3
        IF (N6) 69,69,61
   61   DO 68 I=1,N6,1
        J = J*(K-J)*(L-K)
        K = L*K-(L-J)*K
        L = (L-K)*(K+J)
        E(L-1) = J+K+L
        E(K-1) = J*K*L
   68   CONTINUE
   69   CONTINUE
        CALL POUT (N6,J,K,E(1),E(2),E(3),E(4))
C
C       ***************************************************************
C                       MODULE 7: TRIGONOMETRIC FUNCTIONS
C
        X = 0.5
        Y = 0.5
        IF (N7) 79,79,71
   71   DO 78 I=1,N7,1
        X = T*ATAN(T2*SIN(X)*COS(X)/(COS(X+Y)+COS(X-Y)-1.0))
        Y = T*ATAN(T2*SIN(Y)*COS(Y)/(COS(X+Y)+COS(X-Y)-1.0))
   78   CONTINUE
   79   CONTINUE
        CALL POUT (N7,J,K,X,X,Y,Y)
C
C       ***************************************************************
C                       MODULE 8: PROCEDURE CALLS
C
        X = 1.0
        Y = 1.0
        Z = 1.0
        IF (N8) 89,89,81
   81   DO 88 I=1,N8,1
        CALL P3 (X,Y,Z)
   88   CONTINUE
   89   CONTINUE
        CALL POUT (N8,J,K,X,Y,Z,Z)
C
C       ***************************************************************
C                       MODULE 9: ARRAY REFERENCES
C
        J = 1
        K = 2
        L = 3
        E(1) = 1.0
        E(2) = 2.0
        E(3) = 3.0
        IF (N9) 99,99,91
   91   DO 98 I=1,N9,1
        CALL P0
   98   CONTINUE
   99   CONTINUE
        CALL POUT (N9,J,K,E(1),E(2),E(3),E(4))
C
C       ***************************************************************
C                       MODULE 10: INTEGER ARITHMETIC
C
        J = 2
        K = 3
        IF (N10) 109,109,101
  101   DO 108 I=1,N10,1
        J = J+K
        K = J+K
        J = K-J
        K = K-J-J
  108   CONTINUE
  109   CONTINUE
        CALL POUT (N10,J,K,X1,X2,X3,X4)
C
```

→

With Microsoft FORTRAN-86, the same arguments become 32-bit pointers on the stack: 16 bits for the segment-register value (memory-segment base address); and 16 bits for the general-purpose register value (memory-segment offset). The code for retrieving the 8088 argument value is shown in the right half of Figure 2.

In the Microsoft FORTRAN-86 case, the actual data retrieval is done by the single instruction "MOV DX,[BX]". The remainder of the FORTRAN-86 code is due to a combination of: (1) storing the arguments on the stack; and (2) segmentation.

The additional code required to manage the stack and the segment registers accounts for the larger size of the 8088 code.

Ease of programming

How well does the 8088 meet the design goal of easier programming?

Figure 2 shows that the single 8088 instruction "MOV DX,[BX]" does the work of three FORTRAN-80 instructions. This indicates that 8088 instructions are more powerful than 8080 instructions, on a one-to-one basis.

However, as we have seen, Figure 2 also shows that the total task of passing a parameter is more complex on the 8088 than on the 8080. The overhead due to segmentation and stack-based parameter passing counteracts the instruction-set advantages. When the large-seg-

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```
C     ****************************************************************
C                       MODULE 11: STANDARD FUNCTIONS
C
      X = 0.75
      IF (N11) 119,119,111
  111 DO 118 I=1,N11,1
  118 X = SQRT (EXP(ALOG(X)/T1))
  119 CONTINUE
      CALL POUT (N11,J,K,X,X,X,X)
C
C     ****************************************************************
C                       STOP TIMER,
C                       CALCULATE AVERAGE FOR THIS ITERATION
C
      CALL ETIME (SEC)
      AVER = AVER+SEC
C
  999 CONTINUE
C
C     ****************************************************************
C                       CALCULATE AVERAGE,
C                       PRINT RESULTS
C
      SEC = AVER/FLOAT(NPASS)
      WHETS = 1.0E6/SEC
      WRITE (IOUT,3000) SEC
      WRITE (IOUT,4000) WHETS
 3000 FORMAT (23H CPU TIME IN SECONDS = ,F12.2)
 4000 FORMAT (23H WHETSTONES PER SEC  = ,F12.2,
     1         26H (1 WHETSTONE = 1.0E6/SEC))
C
      STOP
      END
C
      SUBROUTINE PA (E)
      DIMENSION E(4)
      COMMON T,T1,T2
      J = 0
    1 E(1) =  (E(1)+E(2)+E(3)-E(4))*T
      E(2) =  (E(1)+E(2)-E(3)+E(4))*T
      E(3) =  (E(1)-E(2)+E(3)+E(4))*T
      E(4) = (-E(1)+E(2)+E(3)+E(4))/T2
      J = J+1
      IF (J-6) 1,2,2
    2 CONTINUE
      RETURN
      END
C
      SUBROUTINE P0
      COMMON T,T1,T2,E(4),J,K,L
      E(J) = E(K)
      E(K) = E(L)
      E(L) = E(J)
      RETURN
      END
C
      SUBROUTINE P3 (X,Y,Z)
      COMMON T,T1,T2
      X1 = X
      Y1 = Y
      X1 = T*(X1-Y1)
      Y1 = T*(X1+Y1)
      Z  = (X1+Y1)/T2
      RETURN
      END
C
      SUBROUTINE POUT (N,J,K,X1,X2,X3,X4)
      DATA IOUT /1/
      WRITE (IOUT,100) N,J,K,X1,X2,X3,X4
  100 FORMAT (1H ,3I7,4E12.4)
      RETURN
      END
C
      SUBROUTINE BTIME
      CALL SETICK
      RETURN
      END
C
      SUBROUTINE ETIME (SEC)
      CALL GETICK (ITIME)
      SEC = FLOAT (ITIME)/500.
      RETURN
      END
```

ment model is used, the 8088 is actually more difficult to program than the 8080.

Thus, the 8088's enhanced instruction set eases programming slightly for small-segment code. But programming becomes considerably more difficult when you attempt to take advantage of the 8088's extended addressing capabilities.

The observations above apply to programming in 8088 machine or assembly language. There is, of course, little difference in ease of programming in a high-level language such as FORTRAN. As we shall see, however, this does not imply that the high-level language programmer is unaffected by the CPU architecture.

Promotion of better software design

Does the 8088 meet the goal of better software design?

The designers of the 8088 did not attempt to achieve this goal by providing for superior assembly-language software design. Rather, they incorporated features to help support modern high-level languages. Such features included special registers for stack-based parameter passing (to promote writing recursive/re-entrant code) and segmentation (to promote modularity by "discouraging monolithic programs"). Both recursive/re-entrant code and modularity are trademarks of modern languages such as Pascal. The 8088 architecture was designed to cater to these languages; the languages would, in turn, promote better software design.

While recursion, re-entrancy, and modularity have merit, their implementation on the 8088 also has an associated cost, as we have seen: a significant increase in the size and complexity of compiled code. Thus, the goal of better software design, as implemented in the 8088, works against other 8088 design goals—such as increased performance.

The larger, more complex machine code intended to support features of modern high-level languages also works against the goal of better software design itself. Complexities such as segmentation apparently proved sufficiently burdensome on the developers of 8088 system software that the initial high-level language compilers for the 8088 tended to be of very poor quality. This was exemplified by the original IBM-PC FORTRAN. (That may indicate a negative side-effect of assembly-level compatibility. Developers may give older programs a quick retread, rather than doing the job more thoroughly.)

Fortunately, after several years of revisions, 8088 language quality has gradually improved. Nevertheless, the effect of the 8088 architecture on the implementation of high-level language compilers certainly has not been laudable.

High-quality applications programs cannot be based on inferior-quality

compilers. Thus one can only conclude that the 8088's segmented architecture has not been very successful in improving the quality of software written in high-level languages.

To be sure, better compilers can overcome this. But the complexities of 8088 architecture have made the development of better compilers difficult and time consuming.

The moral here is: complex solutions to productivity-oriented problems tend to be self-defeating. (Ada advocates—take heed.)

Better performance—operation-specific

Table 2a contains measured run times in seconds for the six operation-specific benchmarks. Table 2b shows this same data adjusted to reflect all the systems running at the same 4-MHz clock speed. Table 2c is the Table 2b data in easier-to-compare, H8-normalized form. This data has been segregated into the two major classes—math and non-math—and the results in each class have been sorted by decreasing speed.

Two very interesting observations are immediately apparent. First, the ranking

		Benchmark Type					
		Non-math			Math		
System	Version of FORTRAN	Subroutine Calling	Branching	Number-format Conversion	Integer	Real	Functions
IBM PC with 8087	Digital Research F77	4.0	3.0	0.7	1.3	3.5	3.5
IBM PC with 8087	Microsoft F86, version 3	3.0	6.5	1.3	4.0	6.0	4.0
H8 with 9511	Microsoft F80	12.5	9.5	6.0	7.5	39.0	17.5
Z100	SuperSoft F86	6.0	12.5	3.0	7.5	22.0	33.5
Z100	Microsoft F86, version 1	45.0	18.0	23.0	6.0	47.0	93.0
Z100	Microsoft F86, version 3	23.5	3.5	8.0	1.5	74.0	142.0
H8	Microsoft F80	12.5	9.5	7.0	23.0	95.0	191.0
Z100	Digital Research F77	88.0	31.0	32.0	1.3	352.0	386.0

Table 2a. Run-time results of the operation-specific benchmarks. Times are given in seconds.

		Benchmark Type					
		Non-math			Math		
System	Version of FORTRAN	Subroutine Calling	Branching	Number-format Conversion	Integer	Real	Functions
IBM PC with 8087	Digital Research F77	4.80	3.60	0.80	1.60	4.20	4.20
IBM PC with 8087	Microsoft F86, version 3	3.60	7.80	1.60	4.80	7.20	4.80
H8 with 9511	Microsoft F80	6.25	4.75	3.00	3.75	19.50	8.75
Z100	SuperSoft F86	7.16	14.50	3.58	8.94	26.20	39.90
H8	Microsoft F80	6.25	4.75	3.50	11.50	47.50	95.50
Z100	Microsoft F86, version 1	53.70	21.50	27.40	7.20	56.00	111.00
Z100	Microsoft F86, version 3	28.00	4.17	9.54	1.79	88.20	169.00
Z100	Digital Research F77	104.90	36.90	38.20	1.60	420.00	460.00

Table 2b. Relative run-time results (in seconds) of the operation-specific benchmarks. Here, run times are "normalized" for a CPU speed of 4 MHz, providing a system-architecture speed comparison. (See Figure 2c, also.)

		Non-math		
System	Version of FORTRAN	Subroutine Calling	Branching	Number-format Conversion
IBM PC with 8087	Digital Research F77	0.77	0.76	0.23
IBM PC with 8087	Microsoft F86, version 3	0.58	1.6	0.46
H8 with 9511	Microsoft F80	1.0	1.0	0.86
H8	Microsoft F80	1.0	1.0	1.0
Z100	SuperSoft F86	1.1	3.1	1.0
Z100	Microsoft F86, version 3	4.5	0.88	2.7
IBM PC	Microsoft F86, version 1	8.6	4.5	7.8
Z100	Digital Research F77	16.8	7.77	10.9

		Math		
System	Version of FORTRAN	Integer	Real	Functions
IBM PC with 8087	Digital Research F77	0.14	0.088	0.044
IBM PC with 8087	Microsoft F86, version 3	0.42	0.15	0.050
H8 with 9511	Microsoft F80	0.33	0.41	0.092
Z100	SuperSoft F86	0.78	0.55	0.42
H8	Microsoft F80	1.0	1.0	1.0
IBM PC	Microsoft F86, version 1	0.63	1.2	1.2
Z100	Microsoft F86, version 3	0.16	1.9	1.8
Z100	Digital Research F77	0.14	8.84	4.8

Table 2c. Relative run-time results of the operation-specific benchmarks. This provides another system-architecture speed comparison (in addition to Table 2b). Here, the relative values of run times are further "normalized" on the basis of the H8 with Z80 CPU, running Microsoft FORTRAN-80.

of the systems does not change significantly between the two major classes: the systems that are the fastest in math also tend to be the fastest for non-math operations.

Second, the two fastest systems are the ones with math-chip support. This is to be expected in the case of math operations. But it is interesting that math-chip support also seems to benefit non-math operations. Why this should be so is not immediately apparent. However, the Digital Research FORTRAN documentation makes specific reference to this fact; it indicates that the 8087 assists with "address translation," resulting in an across-the-board performance increase.

The moral here seems to be: it may help to use a math chip, even if you are not doing much math.

Of course, if you are doing a lot of math, the results indicate a math chip is *highly* beneficial. This is most obvious in the case of the Digital Research FORTRAN-77. With 8087 support, the 8088 is anywhere from 11 times to 23 times faster than the Z80 for real-arithmetic operations. By itself, the 8088 can be as much as 4.8 to 8.8 times *slower* than the Z80 for real-arithmetic operations.

For integer operations, it makes no difference whether an 8087 is used or not. Integer arithmetic hardware is inherent in the 8088 itself, and so is always available. Thus, the 8088 is always faster than the Z80 for integer operations.

For non-math operations (i.e., subroutine calls, branching, and conversion of numeric format), the large-segment Microsoft compilers run considerably slower than HDOS FORTRAN-80 on a 4-MHz Z80. Execution times for the IBM-PC FORTRAN (version 1 of Microsoft FORTRAN-86) ranged from 4.5 to 8.6 times longer than on the Z80.

The Zenith FORTRAN-86 (version 3 of Microsoft FORTRAN-86) benchmarks took 2.7 to 4.5 times longer to run—except for branching, which was 14% faster. Supersoft's small-segment compiler was roughly comparable to the Z80 for all non-math operations, except branching. (For branching, it was three times slower.)

Digital Research's FORTRAN-77 was amazingly bad for non-math operations when used without 8087 support; there, it was from 7.7 to 16.8 times slower than the Z80! With the 8087, however, FORTRAN-77 was by far the best performer of all in the non-math area; it ran from 30% to 400% faster than the Z80.

Digital Research obviously designed their FORTRAN-77 to take advantage of the 8087 to the greatest degree possible—even to the extent of sacrificing performance when the 8087 was not available. The message from Digital Research is clear: use an 8087, or pay a heavy performance penalty.

One FORTRAN which was not tested was IBM's newly released "Professional FORTRAN" for the IBM PC. According to IBM's new product announcement for this FORTRAN, "The compiler is optimized for high-performance execution...."

This compiler *requires* an 8087 or 80287 math chip. In other words, there are no provisions for software math at all. Here, IBM is even more persuasive than Digital Research: use a math chip, or don't even bother with our language!

Better performance—in the aggregate

The operation-specific benchmarks are useful for looking into the performance of the 8088 for individual types of operations. Most programs, of course, are an aggregate of various operations. The aggregate performance that might be realized by a typical FORTRAN program was measured using the whetstone benchmark discussed earlier.

Table 3a contains run times for the whetstone benchmark, in seconds. Table 3b shows this same data adjusted to reflect all the systems running at the same 4-MHz clock speed, and normalized by the H8 run times. These results have also been sorted by decreasing speed.

As an interesting aside, I have included whetstone-benchmark results in Table 3 for two additional machines. One is a common minicomputer, a VAX 11/780 from Digital Equipment Corporation. The other is a large mainframe computer, a Univac 1108.

The data shows that, even with 8087 math-chip support, 8088-based microcomputers are still at least an order of

System	CPU	Clock Speed	Type of Math	Operating System	Type of FORTRAN	Whetstone Time
Univac	1108	?	hardware	1100 OS	"Athena" F66	0.47
DEC VAX	11/780	10.0 MHz	hardware	VMS	DEC F77	1.3
IBM PC	8088/8087	4.7 MHz	hardware	PC-DOS	Digital Research F77	15.0
IBM PC	8088/8087	4.7 MHz	hardware	PC-DOS	Microsoft F77	16.0
Z100	8088	4.7 MHz	software	Z-DOS	SuperSoft F66	76.0
H8	Z80/9511	2.0 MHz	hardware	HDOS	Microsoft F66	92.0
Z100	8088	4.7 MHz	software	Z-DOS	Microsoft F77	245.0
H8	Z80	2.0 MHz	software	HDOS	Microsoft F66	355.0
Z100	8088	4.7 MHz	software	Z-DOS	Digital Research F77	917.0

Table 3a. Run-time results of the FORTRAN whetstone benchmark, measured in seconds.

System	CPU	Type of Math	Operating System	Type of FORTRAN	Whetstone Time "Normalized" for 4 MHz (seconds)	H8-relative
DEC VAX	11/780	hardware	VMS	DEC F77	3.25	.018
IBM PC	8088/8087	hardware	PC-DOS	Digital Research F77	17.6	0.10
IBM PC	8088/8087	hardware	PC-DOS	Microsoft F77	18.8	0.11
H8	Z80/9511	hardware	HDOS	Microsoft F66	46.0	0.26
Z100	8088	software	Z-DOS	SuperSoft F66	89.3	0.50
H8	Z80	software	HDOS	Microsoft F66	177.5	1.0
Z100	8088	software	Z-DOS	Microsoft F77	287.9	1.6
Z100	8088	software	Z-DOS	Digital Research F77	1077.5	6.1

Table 3b. Relative run-time results of the FORTRAN whetstone benchmark, providing a system-architecture speed comparison. Here, Table 3a's times have been "normalized" based on a CPU speed of 4 MHz (time in seconds). In the last column, relative values are further "normalized" on the basis of the time of the H8 with Z80 CPU, running Microsoft FORTRAN-80.

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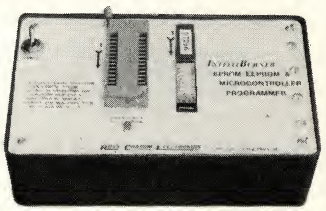

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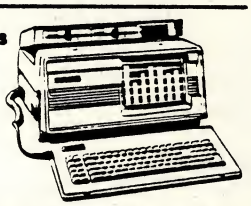

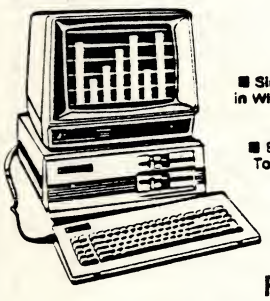

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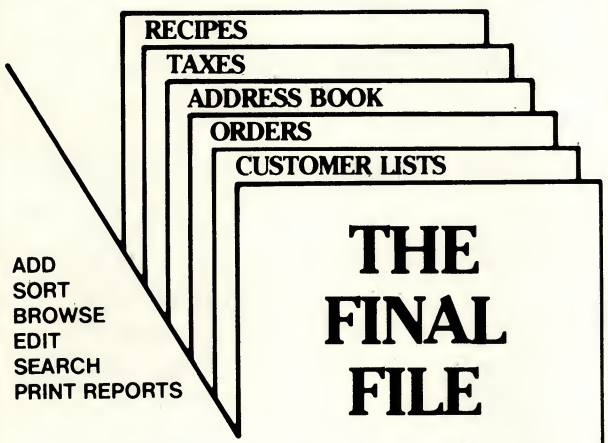

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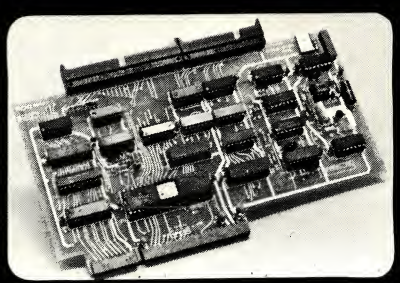

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CPU Chip	Math Chip	Maximum Address Space	Direct Address Space	Register Width	
				Pointer	Data
National 32016	yes	16 MB	16 MB	32 bit	8/16/32 bit
Motorola 68000	no	8 MW	8 MW	32 bit	16/32 bit
Intel 80286	yes	16 MB	4 × 64 KB	16 bit	8/16 bit
Intel 8088	yes	1 MB	4 × 64 KB	16 bit	8/16 bit

Table 4. A comparison of modern CPUs.

magnitude (i.e., 10 times) slower than minicomputers, and about 30 times slower than mainframes. Without math-chip support, microcomputers are hundreds of times slower than the bigger computers. (Of course, the microcomputers are also hundreds of times less expensive!)

The most noticeable feature of Table 3b is, again, the decisive advantage of using math hardware. The slowest math-chip benchmark (the Z80/9511) was twice as fast as the fastest benchmark without math-chip support (Z100 with Supersoft FORTRAN).

Another interesting aspect of Table 3b is the relative ranking of the systems without math-chip support. Both of the large-segment 8088 results are inferior to the Z80's performance. Only the Supersoft small-segment benchmark outperformed the Z80; and this was due only to the onboard integer-arithmetic hardware of the 8088. In all other respects, the Z80 appears to have a higher-performance architecture than the 8088.

How well does the 8088 meet its goal of increased performance?

According to Tables 2 and 3, very poorly, unless an 8087 is used. With an 8087, performance increases dramatically, approaching to within an order of magnitude of a DEC VAX minicomputer. However, the performance improvement due to the 8087 is essentially *independent* of the architecture of the 8088. The poor performance of a solo 8088 indicates that the 8088 may very well be dragging down the 8087; and that the 8087 would be even more effective were it not for the segmentation and stack-maintenance overhead of the 8088 architecture.

General observations

In addition to the specifics discussed above, some general observations can be made from the data. Most of these have already been noted, but they deserve a recap here.

(1) Complex solutions to productivity-oriented problems tend to be self-defeating.

(2) Arithmetic hardware dramatically improves math performance and aggregate performance, and can even improve non-math performance.

(3) Segmentation drags down performance and increases software complexity compared to similar, non-segmented architectures.

These observations indicate that a better CPU architecture would result from (1) using a straightforward, uncomplicated instruction set to enhance ease of programming and to promote better software design, and (2) using wide pointer registers to achieve a large address space, rather than using segmentation methods. Also, (3) floating-point arithmetic hardware *must* be available to ensure high performance.

An alternative to the Intel architecture

A CPU that conforms to the observations above for an improved architecture actually exists today. This CPU is the National Semiconductor 32016.

Of all the major CPUs on the market—including those available from Intel, Motorola, and Zilog—the 32016's instruction set is widely acknowledged to be both the most powerful and, at the same time, the easiest to use. Thus, it meets the first criterion better than any other existing CPU.

The 32016 is also unique in that it is the only CPU currently available with true 32-bit-wide registers in both the pointer group and data group. Because the upper eight bits of the pointer group are grounded to zero, the 32016 has a direct address space of 2^24, or 16 megabytes. The data-group registers are extremely versatile in that they handle 8-, 16-, and 32-bit data equally well. Because 8 bits is the lowest common denominator, the size of a 32016 memory location is 8 bits. Thus, the address space is 16 megabytes, without segmentation of any kind.

For arithmetic operation, the 32016 is supported by the 32081 arithmetic chip. National was not late in recognizing the need for arithmetic hardware, and the 32081 is also available today. (Contrast Motorola, whose arithmetic chip is still under development; and is not expected to be available as a production item for some time.)

The advantages of the 32016 over other currently available CPUs is more clearly seen in Table 4.

A fair evaluation?

A couple of questions come to mind. First, has this test been fair? Is it fair to compare the Z80 with the 8088 in the way presented here?

Notice that we have been comparing the 8088 to the Z80, a CPU which deals with programs under 64K in size. On the other hand, we have been looking at the 8088 performing a function that the Z80 simply cannot perform: segmentation. The 8088 can easily address 256K, four times as much memory as the Z80 can handle. If a trailer can hold four times as much cargo as a station wagon, is it fair to demand the same pound-for-pound fuel consumption?

Well, perhaps and perhaps not.

The 8088 as an optimal solution

If the 8088 and its segmentation architecture are presented as the optimal method of handling 256K, then yes, it should be *at least* as efficient and convenient coping with 256K as the much older Z80 was with 64K. We've come to expect that with advances in technology. At least we should get an explanation of why technology cannot maintain its efficiency when keeping up with expanding memory demands.

However, we would also want to test the 8088 against other chips that also handle 256K (or more). In this regard, Table 5 shows some FORTRAN whetstone benchmarks for Motorola's 68000 CPU. These are taken from a very nice article in the January 1984 issue of *Unix/World* ("Enhanced Supermicro and the VAX/780," by Joe Germann).

Although I do not regard the 68000 as the best alternative, the figures in Table 5 indicate that it outperforms the 8088. The difference is most dramatic when both chips operate without any arithmetic-hardware support. The 68000's worst speed in the *Unix/World* tests is still faster than the 8088's best speed in the Z100 tests that I ran. And its best speed is three times the 8088's best

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speed.

With hardware-math support, however, the difference is less dramatic. At its best, the 68000 was twice as fast; at its worst, it fell behind the 8088 by about 23%. On balance, however, the 68000 still appears significantly faster than the 8088.

What is the explanation for the disparity in relative performances with and without arithmetic hardware? Arithmetic hardware is "the great equalizer." It de-emphasizes the effects of CPU architecture on performance.

Regardless, the bulk of the figures indicate that segmentation imposes significant costs both on speed and on ease of programming. Clearly, the 8088 is not an optimal solution.

The 8088 as a compromise

If, however, the 8088 is presented as a *compromise*, then no, it may not be entirely fair to compare it either to the Z80 or to competing chips like the 68000 and 32016. A compromise always involves costs.

In this regard, it is understandable that Intel would not present the 8088 as a compromise. However desirable a compromise may be, the word conjures up the idea of "second best." But the architecture of the 8088 *is* a compromise. And part of the purpose of this article has been to point that out.

Saying that the 8088 is a compromise, however, raises the second question: is the compromise worth it? That is, were the proper tradeoffs made?

In reading this article, it should be obvious that I do *not* find the 8088 a prudent compromise. But in judging such a compromise, we should not dismiss the reasons behind it. If the costs of such a compromise are technological, the benefits are economic. Developers who produced programs for the 8080 and Z80 chips will benefit from assembly-language compatibility. The programs they sold to users may not run on the 8088; but it is a relatively straightforward process to convert the assembly-language originals to run on the new chip.

That may *seem* to provide no benefit to the user inasmuch as we still end up running the same old programs. But it is a fundamental element in supporting a CPU. If you were a developer, would you care to write software for a chip whose manufacturers will leave you out in the cold with every new design?

Intel's position appears to be this: they best support their users by providing an environment where developers are encouraged to write software for Intel CPUs. More developers writing more software will produce better software and less expensive software. And the more commitment Intel has to the people who write software for Intel CPUs, the better it will be for users. Compatibility proves that commitment. In the long run, the *costs* of segmentation will prove to be a small price to pay for the *benefits* produced by compatibility.

If that argument is insufficient, the 8088's defenders can respond with an even more convincing one: IBM decided to use the 8088. Given the name "IBM," we automatically get a large user base. Even if it is harder to program for the 8088, developers will do so. Even if it may be more expensive to develop a program, the costs will be spread out over more users. Perhaps the code may not be as fast as we would like, or as compact. But the user gets less expensive software and a greater choice than is available for technically superior chips.

The analysis *sounds* persuasive; unfortunately, I have to disagree with it.

Quantity vs. quality

Even though National's 32016 CPU is superior from a technical standpoint, relatively few hardware manufacturers are using it. The reason for this is that the 32016 is a relatively new chip. And therefore there is not a great deal of software available for it. Conversely, the Intel line, while technically not the best, has the most software support. Hence, it is the most popular with hardware developers, Heath/Zenith included.

The decision to select a CPU based strictly on the amount of software available for it is a very widespread practice. Despite its popularity, I find this criterion shortsighted, since it ignores a very significant question.

Is all that available software any good?

As we have seen, the segmented architecture of the 8088 did not encourage the development of very good compilers. Applications programs developed in such an environment are also likely to be of lesser quality, particularly compared to what *might have been developed* had a *better* CPU been selected.

I would suspect that most users, given a choice, would prefer one good spreadsheet over a wide selection of comparatively mediocre ones; or one high-performance compiler over a half-dozen lower-performance ones; and so on. Unfortunately, the industry seems to be overly concerned about quantity of software, to the detriment of a more important issue—*quality*.

One fact of software development is

System	CPU	Clock Speed	Type of Math	Operating System	Type of FORTRAN	Whetstone Time	"Normalized" for 4 MHz
*	68000	12.5 MHz	hardware	Unos 3.0	F77	3.4	10.6
Apollo	68000	10 MHz	hardware	Aegis 4.0	F77	6.2	15.5
IBM PC	8088/87	4.7 MHz	hardware	PC-DOS	Digital Research F77	15	17.6
IBM PC	8088/87	4.7 MHz	hardware	PC-DOS	Microsoft F77	16	18.8
*	8088/87	5 MHz	hardware	*	Intel F77	16	20
*	68000	8 MHz	hardware	Unix V7	F77	10.0	20
*	68000	10 MHz	hardware	*	F77	9.4	23.5
*	68000	8 MHz	hardware	Unix V7	F77	13.0	26
Apollo	68000	10 MHz	software	Aegis 4.0	F77	13.1	32.7
*	68000	8 MHz	software	Unix V7	F77	22.2	44.4
*	68000	12.5 MHz	software	Unos 3.0	F77	14.4	45
*	68000	10 MHz	software	*	F77	22.7	56.7
*	68000	8 MHz	software	Unix V7	F77	33.5	67
*	68000	8 MHz	software	Unix V7	F77	42.5	85
Z100	8088	4.7 MHz	software	Z-DOS	SuperSoft F66	76	89.3
Z100	8088	4.7 MHz	software	Z-DOS	Microsoft F77	245	287.9
*	8086	5 MHz	software	*	Intel F77	390	487.5
Z100	8088	4.7 MHz	software	Z-DOS	Digital Research F77	917	1077.5

Table 5. Run-time results (in seconds per iteration) of the FORTRAN whetstone benchmark comparing the 8088 and 68000 CPUs. In the last column, relative values have been derived based on a 4-MHz clock speed to facilitate comparison with the figures in Table 3b. An asterisk (*) indicates that information was not available. All Z100 and IBM-PC tests were conducted by the author. All other test results were published in the January 1984 issue of *Unix/World*.

pervasive enough that writers note it again and again. Someone creates a VisiCalc or a dBASE II, then the industry produces endless variations on the theme—until someone else makes the next breakthrough. Then the industry jumps on that bandwagon. What causes people to make the breakthroughs? A desire to be on the bandwagon? Or a concern for quality and excellence? It's been my own experience that challenge and a programmer's personal sense of satisfaction produce better software than the bandwagon can produce.

To be sure, we may not always need imagination and excellence. You may be a user who needs a highly specialized package, agricultural accounting, say. Such packages are more likely to be written for use on the bandwagon. But the quality and utility of even those packages are likely to be affected by technical considerations.

The measure-of-merit data presented here indicate that quality software requires quality hardware. Inferring from the same data, it is highly likely that the thousands of applications now available for the 8088 are of relatively lower quality than what might have been accomplished with a better CPU architecture. This, perhaps more than anything else, is the most costly compromise of the 8088 design.

In economics, there is a term for options passed up—"opportunity cost." The opportunity cost of the 8088 appears to be very high.

If one accepts the twin tenets that a few superior-quality applications are worth a storeful of merely fair ones, and that quality software requires quality hardware, then the selection of a technologically superior CPU (such as the 32016) is highly justified, regardless of the quantity of software that may be available for a CPU such as the 8088.

To the credit of many hardware developers in the industry, usage of the 32016 is increasing at an appreciable rate. I for one hope that Heath/Zenith is next to join the small but expanding group that has decided to stop paying the opportunity cost of segmented architectures and math-chipless computer systems.

Additional Information

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HDOS FORTRAN, $175. Also available for CP/M-80 or -85 on hard- or soft-sectored 5" disks, $195.
Zenith FORTRAN–86, $195.
Available through Heathkit catalogue and at Heath/Zenith Computers and Electronics Centers.

Supersoft FORTRAN-86, $425.
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FORTRAN-77, $500.
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Math Hardware Support

The following list includes products for Heath/Zenith computers, from the H8 through the H/Z150-160.

8087 speed and power booster for Z100.
D.E.L. Professional Systems, Inc.
In U.S.:
2110 Etna Place
Monterey, CA 93940
800/663–8331
In Canada:
12–11151 Horseshoe Way
Richmond, B.C., V7A 4S5
604/274–0434

H89UTI—utility board for H/Z89, replaces serial I/O card. Includes AM 9511A high-speed math processor. Also includes calendar/clock with programmable interrupts and choice of three types of backup battery; bi-directional parallel interface; and two standard RS–232 serial ports. Many configurations available. Printer support package options allow use of parallel port with Epson MX-80, MX-100, and other printers.
FBE Research Company
P.O. Box 68234
Seattle, WA 98168
206/246–9815 (evenings)

8087 numeric co-processor for Z100 and Z150/160, plugs into existing socket on Z150/160. On Z100, circuit board provided for 8087 and 8088; this plugs into 8088 socket.
8087 chip for Z150/160, $185.
8087 circuit board for Z100, $375.
First Capitol Computer
1106 First Capitol Drive
St. Charles, MO 63301
314/946–1968, 800/862–8948

Z Support Board for Z100—allows the user to add 8087 numerical data processor and 256K to the Z100. Plugs into Z100 expansion slot; operates with no operating system modification. Allows user to run both 8085 and 8086 code; allows 8087 hardware interrupt for exception handling. Technical manual contains installation procedures, circuit description, theory of operation, and schematics.
Option 1—8087 circuitry, fully assembled and tested; socketed for 256K upgrade (memory circuitry not tested); $595.
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Upgrade kits available.
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AM9511 — FORTRAN-transparent library for single 9511 chip, replaces FORTRAN math routines, $39. For use with Trionyx M/2-H8 board.
AM9511B—same as AM9511, for use with NOGDS HA–89–3 board.
AM9512—same as AM9511, for single 9512 chip.
AM9512B—same as AM9511B, for single 9512 chip.
PPL11—parallel processing library for concurrent operation of multiple 9511s.
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HA–89–3 color graphics board for H/Z89, $299. Optional features include AM9511A arithmetic processor, $175.
HA–8–3, same as HA–89–3, for H8.
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M/2–H8 math board for the H8. Has dual sockets for 9511 and 9512 arithmetic processor chips. Any combination of 9511 and 9512 chips may be installed.
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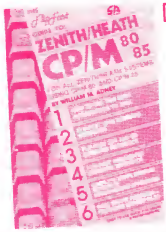

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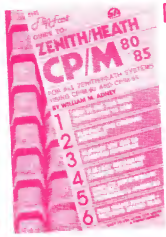

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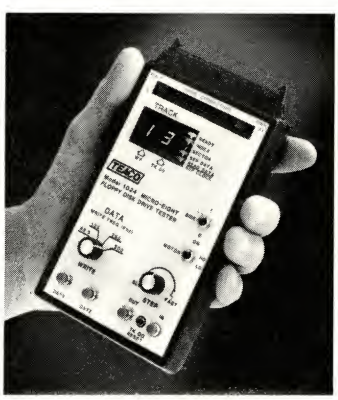

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Robert A. Hanan, M.D.

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You have two choices. You can add more random-access memory (RAM)—via chips or a board. Or you can split your program into shorter modules.

Let's consider the latter choice—and take a detailed look at the way the CHAIN and COMMON statements work with both the BASIC interpreter and the BASIC compiler.

The exposition of the CHAIN and COMMON functions given here applies to both Microsoft BASIC under CP/M-80 and Z-BASIC under either the Zenith Disk Operating System (Z-DOS) or the Microsoft Disk Operating System (MS-DOS), and to their respective Microsoft BASIC compilers.

Passing variables . . .

Generally speaking, the nature of most application programs is such that splitting them into smaller segments means that you have to find a way to pass variables between the segments. This requirement effectively rules out the use of two of the commands available in BASIC for calling other programs from within a program—namely, RUN and LOAD.

When RUN or LOAD is invoked, BASIC automatically closes all open files and resets all variables to zero or null. Of course, you could reprogram the segments so that you could re-enter the necessary variables or constants. But this would not be "good style" and would soon become annoying.

The answer is to use the command "CHAIN" and its adjunct "COMMON".

. . . with CHAIN and ALL

The CHAIN command is placed within one program to call another. To call "PROG2" from within "PROG1", the simplest form of the CHAIN command would be:

```
CHAIN "PROG2"
```

Without any line number specified, PROG2 would begin execution at line 1. Of course, a drive designation may precede the name of the called program.

But no variables would be passed to PROG2 in the form above. Such variables must be specified in a previous COMMON statement; or the parameter "ALL" must be added to the CHAIN statement. However, if you use ALL, BASIC's syntax requires you to specify the line number at which execution will begin. For example:

```
CHAIN "PROG2",100,ALL
```

If ALL is used without the line number, no variables will be passed to PROG2.

The line number may be used without ALL if it is not necessary to pass any variables:

```
CHAIN "PROG2",100
```

Your computer takes ALL literally.

ALL's limitations

If the ALL parameter is used, the COMMON statement is not used.

Fine, you say, I'll just forget about COMMON. Well, sometimes a problem arises through the use of ALL. Your computer takes ALL literally. If you use it, you pass more than just such variables as file-record numbers, string names, and numeric values. You also pass dimension statements, function-key assignment codes, and cursor-control codes. It may pass so many variables to PROG2 that you will get an "out of memory" error message when the variables in PROG2 are added to the variables of PROG1 in active memory.

In other words, you have recreated the situation that led you to split the programs in the first place. The only way to avoid this problem is to use COMMON to pass only the variables you select.

A corollary arises if those dimension statements, cursor-control codes, etc., are to be used in the called program. If you use COMMON instead of ALL, you have a choice: either you have to restate those codes and statements in the called program; or you have to add them to the list of COMMON variables. The first method is probably easier.

COMMON's limitations

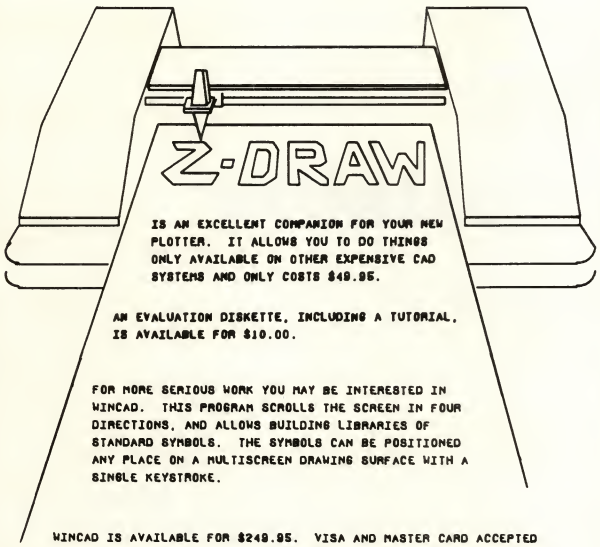
COMMON has some peculiarities. Your manual probably says "COMMON statements can appear anywhere in a program." But it recommends that the COMMON statement appear at the beginning of the program.

This is mandatory if you wish to compile your BASIC programs. Then the COMMON statement must appear at the beginning of your program, before any executable statements.

"Executable statements" includes just about everything except COMMON itself, the DEF FN and DIM statements, REM, and OPTION BASE. In certain instances, the net effect of this restriction may be that it is impossible to use some statements or commands.

Take, for instance, the CLEAR statement. If you place the CLEAR statement before a COMMON statement in your program, the compiler will give you a "CO" error, meaning "COMMON out of order." But if you put CLEAR in your program after the COMMON statement, it will erase your common variables and you will get an "illegal function call" error when you go from PROG1 to PROG2.

I suppose one can conclude from all this that the BASIC interpreter is flexible enough that it can deal with the



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code no matter where the COMMON statement is; but that the compiler cannot, presumably because it is a "one-pass" compiler.

Using COMMON

The form of the COMMON statement in PROG1 is:

```
 50 COMMON A,B$,D( )
100 CHAIN "PROG2",10
```

And PROG2 also has a line that reads like line 50 above.

As line 50 indicates, COMMON variables can be a string, a number, or an array (specified by "( )" after array name). Note that the COMMON statement must be in the called program as well as in the calling program. (And be sure that the line number specified in the CHAIN statement is lower than the line number of the COMMON statement in the called program.)

To leave open the possibility of compilation, make sure that the *order* of variables is the same in both COMMON statements. However, I have found that it is possible to vary the *number* of parameters in the COMMON statements. It must be done in such a way that the variables are added to or subtracted from the end of the list, without changing the order of the remaining variables. This is useful when you have to pass variables to some programs and not to others.

The example given above includes a line number in the CHAIN statement. This works fine in interpreted BASIC. But if, again, you want to leave open the possibility of future compilation, you should be aware that the *compiler* will not accept a line number as part of the CHAIN statement.

It is simple enough to erase the line-number specification if you decide to compile your programs some time in the future. But too often, this simple act will mean that you have to restructure your programs. They may have to be split into modules that begin where you want execution to begin. You will probably have to break programs into more modules than are necessary for operation under the BASIC interpreter.

However, you can usually get by without line-number specifications in the CHAIN statement. It is frequently sufficient to employ a combination of duplication of modules and judicious use of GOTO or GOSUB statements in the first lines of some modules.

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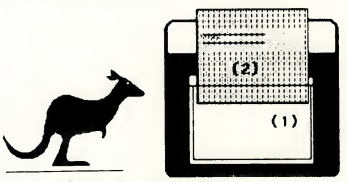

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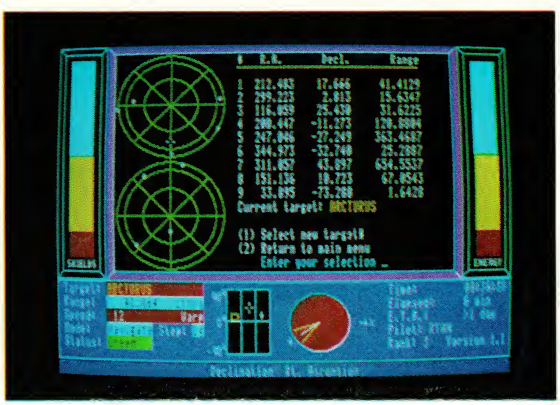

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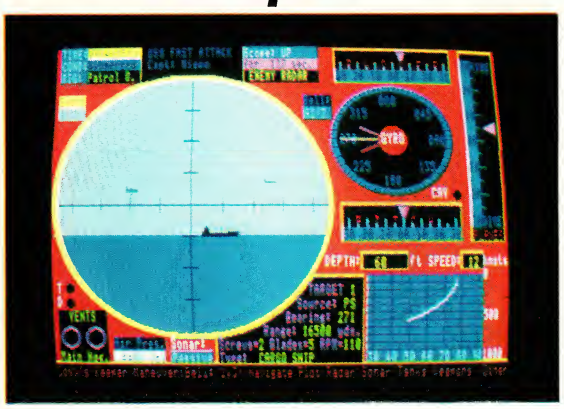

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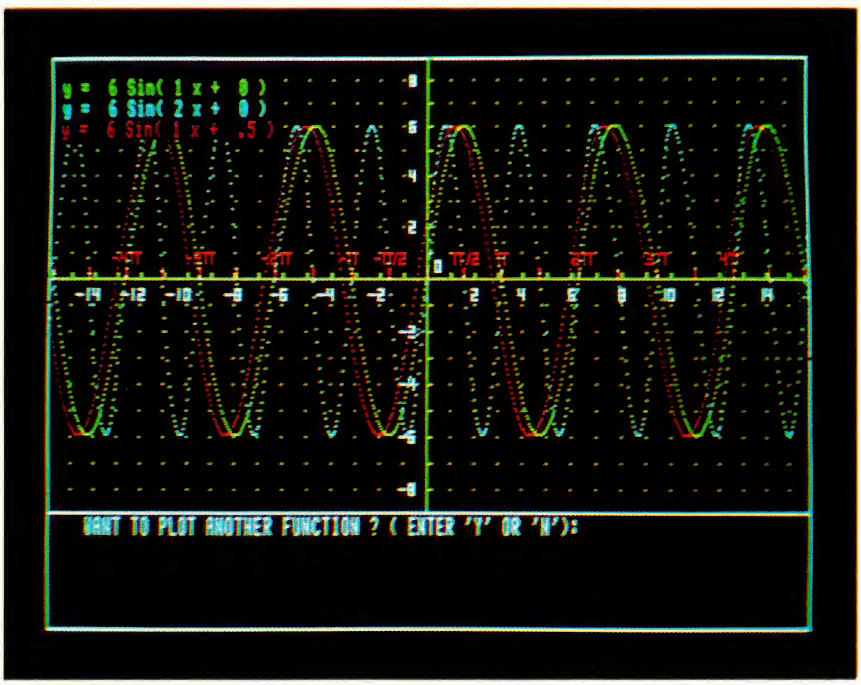
The program uses the excellent graphics capabilities of the Z100 to produce graphs such as the one shown here. The user enters the variables or coefficients in the equations as they are presented on the display, and DEMOGRAF plots the equations. Six different curves may be plotted on a single display. Each plot is shown in a different color, and the corresponding coefficients or equations are shown in the appropriate matching colors.



DEMOGRAF comes in two versions, one for the teacher and one for the student. The teacher's version includes suggestions on using DEMOGRAF in the classroom, a sample lesson plan, and student worksheets.

The program is provided in compiled BASIC, and runs under Z-DOS. It requires a Z110/120 with 128K of RAM. A color monitor is recommended, but not required.

DEMOGRAF is priced at $39.95 for the student version and $44.95 for the teacher version. Add $3 for shipping and handling. Additional graphics worksheets are available for $4.95 each. Add $1 for shipping and handling. Both products are available from Teach Tech, Route 4 Box 161C, Chetek, WI 54728. Wisconsin residents add 5% sales tax.

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Two markers designed specifically for use on computer disks and labels have been introduced by Sanford Corp.

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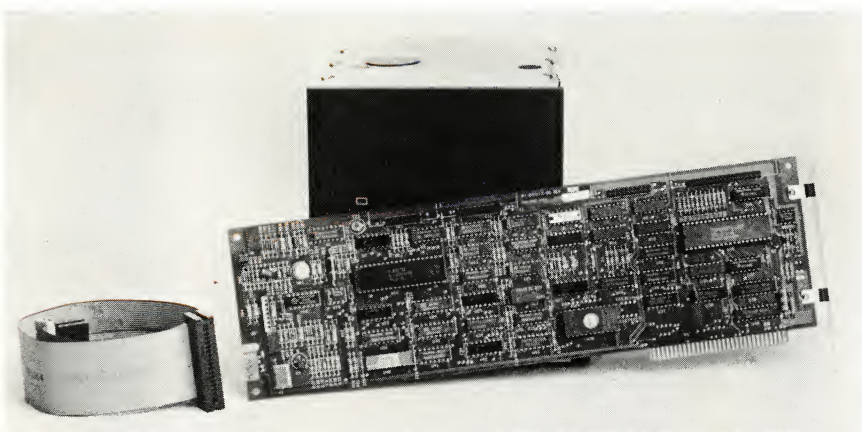
Suggested retail prices are $2.50 each for Diskribe and $1.00 each for the Label Pen. For further information, contact Sanford Corp., 2740 Washington Blvd., Bellwood, IL 60104, 312/547–6650.



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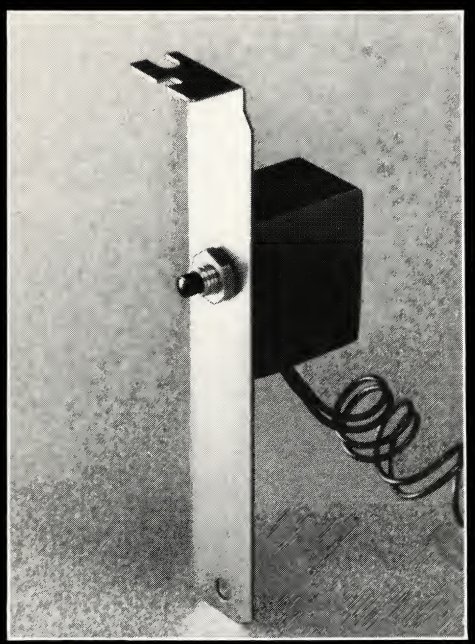
The kits are available exclusively from First Capitol Computer, 1106 First Capitol Drive, St. Charles, MO 63301, 800/862–8948 for orders, 314/946–1968 for further information. For prepaid orders, add 2% shipping for domestic U.S. delivery. For international orders, please contact First Capitol Computer.



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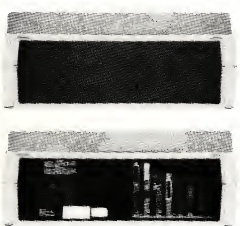

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Scuttlebutt

Zenith Data Systems has **scrapped their plans** for the laptop computer discussed here last issue—but not before it was pictured on the cover of *Personal Computing*'s March issue. Word is Zenith is planning to put their name on **a version of Morrow's Pivot**.

And *InfoWorld* reports Zenith is working on **an IBM PC AT clone**. After working on it for over a year, Zenith expects to release it in July. *InfoWorld*'s sources attribute the "slow turnaround" to "the **perverse insistence** by Zenith's engineers on doing things just *exactly* right." Actually—given their history—we're pretty impressed with their speed. (Even though it's no fun to wait, it's nice to know that Zenith products actually *work* when you get them.)

This "perverse insistence" is apparently also at the root of Zenith's delays in releasing **MS-DOS versions for the '100**. A beta tester for an early version of MS-DOS cautions us not to expect version 3 for the '100 before Microsoft brings out version 4—it takes ZDS engineers that long to **get the product to work**.

This is the fourth issue of *Sextant* to carry an ad for **D.E.L.'s IBM emulator board**. It's generated a great deal of interest from the start—much of which by now has changed to skepticism, as people wait for the product to appear.

D.E.L. has been negotiating with Heath to sell the board through the Heathkit stores. Apparently these negotiations are foundering. (The reasons vary according to whom you ask.) D.E.L. is planning to distribute the board through other channels.

A separate rumor has **U.C.I.**, best known for their memory boards, **also working on an IBM emulator** for the '100.

Meanwhile, the Z319 board from Heath/Zenith does the opposite—it **lets the Z150 run Z100 software**. Dale Wilson reported on HUG SIG that the Z319's graphics emulation is "perfect." But "the keyboard emulation, on the other hand, to put it politely—well—it **can't be put politely**." Programs that make use of the '100's function keys will be difficult, at best, to use. CPS communications software and Lotus 1-2-3 won't run. And the '319's ROM addressing conflicts with that of some early Winchester controllers.

Model Railroader carried an article in its February 1985 issue by a man who's hooked up his "**Sunset Valley line**" to an H8. He uses the H8 primarily to operate the railroad's switches, and insists that he does *not* let the computer **run the railroad**. (Who knows what happens when he's out of the room.)

A reader reports that the IMAGE word and picture processor is **no longer supported** for Heath/Zenith computers. IMAGE, from MicroArt Corp. of Portland, Oregon, was reviewed in the Winter 1983 issue of *Sextant*.

A "bomb" program going by the name VDIR.COM has shown up on a West Coast bulletin board. The documentation for the program says it produces a vertical directory listing. However, when run, the program **destroys all the data** on the directory and system tracks, and fills them with garbage.

We've also heard of a "Lock/Unlock" program which encrypts files but will not decrypt them.

The **moral of the story**: Even if you think you know what a program's going to give you, it's wise to put it on **a disk you can afford to ruin**.

Survey results from a Dallas research firm, reported in *InfoWorld*'s March 25 issue, suggest that **ZDS's micro-computer market share** for 1985 **will drop from 2% to 1%**. Compaq, the leading IBM PC clone manufacturer, is expected to drop from 4% to 2%.

Time to start planning for the **1985 HUG conferences**:

HUGCON 4 will be held August 9–11 at the Hyatt Regency O'Hare in Chicago. This is the same **convenient airport location** that HUGgies enjoyed two years ago.

Maybe this year we'll have a chance to see the long-awaited **HDOS 3?** (And you thought D.E.L.'s Gemini board was slow!) Attendees at HUGCON 3 may remember that **early 1985** was suggested then as the estimated time of arrival for HDOS 3.

And **a two-day conference** has been scheduled for **CHUGCON 85**. This will be held at the same location as *last* year, the Crystal City Hyatt Regency in Arlington, Virginia, on November 2 and 3.

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Here are some of the highlights of each issue:

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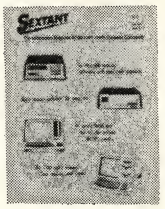

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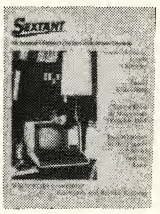

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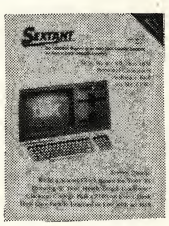

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To get in touch with your fellow Heath/Zenith users, place your short notice in *Sextant*'s classified section. The rate is only 75¢ per word with a minimum of 15 words. Send your typewritten ad and payment to: Sextant, Classified Ad Department, 716 E Street, S.E., Washington, DC 20003. Please include your name and telephone number for our records. We need to receive ads for the July-August issue by May 15, and for the September-October issue by July 10.

Luminaries

Ray Albrektson lives in the Philippines, where he's a faculty member of the International School of Theology–Asia. Over there, if he wants an enhancement for his computer, he has to make it himself.

Jonathan Booth is a musician living in Boston. He recently co-authored a book on solar houses with his father. So he had to know which version of a manuscript was the latest.

Edward A. Byrnes is a former Marine and philosophy student. He devotes himself full-time to his software company, Intuitive Logic. Maybe intuitive logic is what it takes to remember a sequence of 49 shapes on the screen.

Charles Corbin runs a typesetting business in Minnesota. You can be sure someone who typesets from disk and modem isn't going to compile his customer account lists by hand.

Jack L. Goertz is a Senior Systems Engineer for a design engineering firm in Birmingham, Alabama. He owns a bicycle specialty store which sells only tandem (two-seater) bicycles. His CP/M activities include contributing on CP/M topics to *Computer Trader* magazine and moderating/contributing to the CP/M message board on a local bulletin board.

Robert A. Hanan, M.D., is a pathologist living in Southern California. His software company, LabSoft, offers data-processing software for clinical laboratories. And he's quite good at keeping BASIC programs healthy.

Rick Lutowski is a naval architect and proprietor of a software company which sells FORTRAN support products for HDOS. A proponent of the 8088 when the Z100 was first introduced, three years and many benchmarks have changed his opinion.

Karen D. Morton is a student of electrical engineering technology. Her interests include computers, robotics, and science fiction and fact. Luckily, her expectations for the Imaginator turned out to be more fact than fiction.

Wayne Rash, Jr., works for American Management Systems in Arlington, Virginia. Since he always seems to have a review in the works for *Sextant*, he should double his output with a 7.5-megahertz clock speed.

Walter M. Scott, III, is an electrical engineer with ten years experience in instrumentation, control, and electronics. His home control system was described in survey articles in *Sextant* issues #14 and #15. So now he can get a high-resolution picture of his coffeemaker as he turns it on.

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